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December 19, 1918

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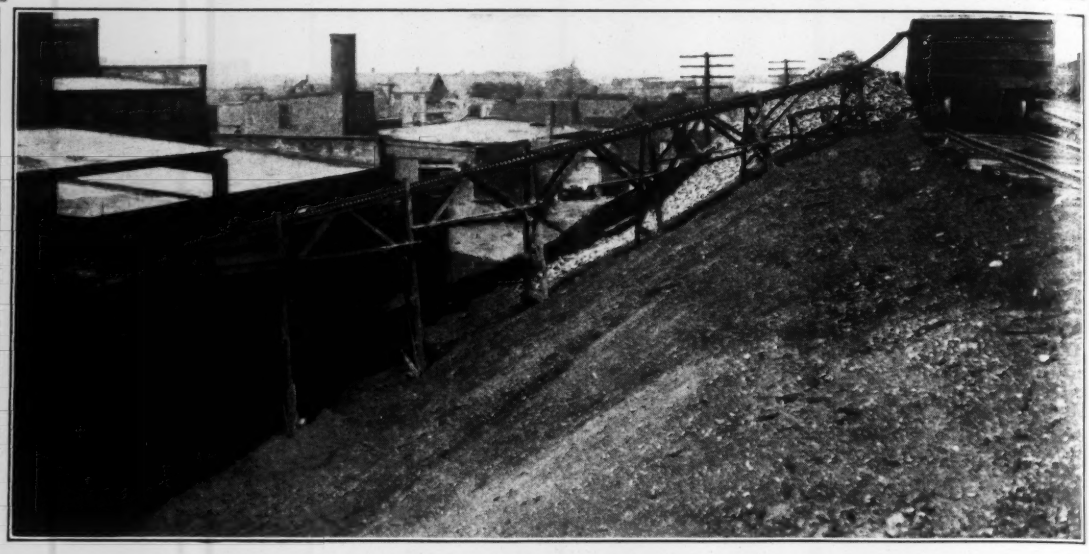

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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. MEHREN, Editor

CHARLES WHITING BAKER, Consulting Editor

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Good Roads Vote Decisive All Over Illinois

NOT often has a bond issue for good roads been so handled from the educational standpoint that the issue has been carried in practically every county of a state. The official count in Illinois shows that every one of the 102 counties rolled up an actual majority, only two falling slightly below a constitutional majority, half the highest vote for members of the legislature. Of these two counties, one has a very small mileage of the proposed routes, and the other had a strong political leader unconvinced of the merits of the project. Candidates who were against the bond issue were almost invariably defeated. This augurs well for Minnesota with its proposed $100,000,000 project, if only a proper educational campaign is started far enough in advance and is conducted on nonpartisan lines.

Prejudice or Incompetence

DURING the season of 1918, just closed, the New York State Canals carried less freight than they did in 1917. Doubtless, more elaborate figures and some explanations will later be given out by the United States Railroad Administration, which now controls the canal, but deductions from the bare statement of fact cannot be escaped. If, in spite of the difficulties in procuring boats and some deficiencies in the depth of the canal, a Federal administration with plenary powers of freight allocation and rate control could not send more tonnage over a modern barge canal than was carried last year over the narrow and shallow waters of the century-old Erie Canal, then one of two things is so: Either that administration is woefully incompetent, or it has prejudices against inland waterway navigation.

Problems in Determining a State Highway System

MR. HIRST'S paper, of which the second and concluding part appears in this issue, is so comprehensive a review of a problem that is now critical in all states—the determination of a state highway system—that we strongly urge its reading, not merely upon engineers and contractors engaged in highway work, but on all who have any connection with engineering and construction work. Large policies in engineering matters are determined to a considerable extent by the attitude of the public, and this every engineer and contractor is in a position to influence. Many points in Mr. Hirst's paper might be discussed, but particular emphasis should be laid upon his strong plea that a state upon designating a route as part of the state system should undertake its maintenance even before any new work on it is done. The past practice has been to take over the routes only after a new pavement has been laid. Mr. Hirst argues, with good reason, that immediate control of all routes designated as parts of a state highway system is a desirable policy. Local communities always neglect routes when they know that they are to be taken over by state authorities, while maintenance of even inadequate surfaces results in economy in haulage cost as compared with traffic over neglected roads. Mr. Hirst contends that the results in Wisconsin fully justify the adoption of the policy. We believe that engineers generally will agree with his point of view. Maintenance of existing surfaces is a good forerunner to the laying of roads of improved types.

Guarding Against Influenza Recrudescence

INFLUENZA is again on the increase. Everyone responsible for men and women gathered together in office, camp or shop should be forehanded with plans to meet a possible outbreak of the disease, and alert to forestall its spread. Concise directions to this end may be obtained from the United States Public Health Service, Washington, D. C., and from any of the more progressive state and local boards of health of the country. For the individual, greatest safety lies in keeping beyond the range of droplet infection from influenza victims who are giving out the specific germs by coughing, sneezing or talking. Inoculation against the disease and mask wearing are at least worth considering. Patients should be isolated, and bedside disinfection practiced. The chances are that before the winter passes those over forty years of age, who so largely escaped last fall, will be attacked. Finally, it should be remembered that regardless of influenza sequelæ the next few months will doubtless show many other cases of pneumonia, which is a communicable disease to be guarded against by the same general methods as apply to influenza.

Working Under Divided Responsibility

NEW attacks made on the Hog Island shipyard in the Senate evidence either a lack of subjects for debate or inability to get the proper perspective of this abnormally big enterprise. Undoubtedly, this effect of size is at least a factor in the matter; it is hard for statesmen to realize how far beyond all precedent was the task assigned by the Emergency Fleet Corporation to the Hog Island plant. Unfortunately, attacks such as these operate to delay and disorganize the work—which is still under the same driving pressure for speed as at

the start. Yet one good result might come out of the matter if Congress should enter into a real study of the enterprise; the evils of divided responsibility might be laid bare. When the history of the Fleet Corporation's work comes to be written, the remarkable agency-yard system will surely call for a chapter of its own. Under this system as practically applied, authority and responsibility are divided, the former residing in the Fleet Corporation while the latter rests on the agent. Spirit, energy, speed, cannot be expected in these premises. Notwithstanding this obvious fact, the agency yards have made wonderful performances, but until the Emergency Fleet Corporation renders account of its stewardship in the administration of these yards the country will not be in a position to judge where the credit and where the blame should be placed.

German Bureaucrats and Water Engineer Piefke

READERS of Dante's "Inferno" will remember the remarkable mental ingenuity of the author in devising punishments suited to the earthly sins of those who were undergoing punishment. The subject is recalled by the experience of a victim of German bureaucracy a quarter century ago, brought to light by George W. Fuller in an address from which extracts are printed on p. 1121. Piefke was an apostle of water filtration at a time when German officialdom, extending to even the Kaiser himself, it is said, was forcing the use of ground water instead of filtered surface water. This great water engineer, worried in his advancing years over titles and degrees, as the letter now given out by Mr. Fuller shows, was finally taken away from the congenial task of operating water filters and made recorder of ground-water statistics. Thus did the German iron hand equal both Dante and Gilbert and Sullivan in "making the punishment fit the crime."

Selection of Secretary of New Contractors' Association

NO ASSOCIATION of business or professional or trade interests is organized merely by naming its directing officials and codifying its purposes. Complete organization is a far more comprehensive series of processes and developments. It involves the selection and coördination of a working force; the creation of an active membership and a financial reserve; the practical application to its industry of a definite plan of service. To insure these accomplishments there must be the highest quality of management. Success of the Associated General Contractors of America, nominally organized four weeks ago in Chicago, will depend upon securing a good manager of the association. Specifically, success will depend upon securing a good secretary—a good working manager. Granting every credit deserved by president, vice-president and directors, still, they play a smaller part than does the secretary. The title of the office is unfortunate; it smacks too much of the desk worker and the keeper of records. A successful working secretary for an active business association is less the traditional secretary than he is the managing director of a business enterprise. Cognizance of this fact must stand solidly behind the choice of secretary for the new contractors' organization and behind the determination of the secretary's compensation.

The Decision as to Future Railway Control

PRESIDENT WILSON has referred to Congress for decision one of the most momentous questions that has ever confronted that body: Are the railways of the United States, which were taken over for operation by the Government during the war, to be returned to the owning companies—with reëstablishment, so far as possible, of pre-war conditions; is the experiment of Government operation to be continued for a term of years, as Director General McAdoo recommends; or is some middle course, as yet uncharted, to be followed?

From the numerous expressions of public opinion which have appeared since the President's message brought the railway question to the fore, it is easy to find substantial agreement on two points: That the railways should not be returned to the pre-war status, and that business men, at least, are generally opposed to the transfer of the railways to public ownership.

It seems worth while to enumerate some of the chief points in which, if the roads are returned to the companies, conditions are likely to be different from what they have been in the past.

In the first place, we have probably seen the end of competition in the railway business. Of course, direct competition in rates was practically ended years ago; but such competition in service as existed the experience of the war has shown to be more wasteful than beneficial to the public. This competition was responsible for more fast passenger trains and more frequent fast-freight service than were really needed, an expensive corps of agents to solicit traffic, and needless duplication of terminal facilities and offices. Now that the Government has demonstrated the public benefit of eliminating these and other wastes due to competition, it is not likely in future to enforce laws which have in the past kept the railway companies from agreeing among themselves to prevent such wastes.

In the second place, there is general agreement that Government control of the railway business must continue and must be made more thorough. When we come to the question what that control is to be and how it is to be exercised, the agreement disappears. It sounds well to say that Government control should in future be unified and effective and should be so exercised as to restore the financial status and credit of the companies; but is there any real likelihood of such changes in the existing methods of Government control? "Unified control" may be taken to mean that the present dual control by both Federal and state authorities should cease; but there appears to be no method short of an amendment to the Federal constitution by which the states could relinquish their control of intra-state traffic. Such an amendment would have hard sledding. State legislatures will be loath to yield their power over railways, which carries with it the power to protect a state's commercial cities against rival traffic centers in other states.

The Federal control of the railway business, if the roads go back to the companies, is certain to be much more complete. The Interstate Commerce Commission is already on record as urging that if the roads are returned to the companies no new railway construction or extensions shall be allowed except by Government au-

thorization. Such restrictions have been for years in force in several states, and will probably be made nation-wide. Similarly, the supervision over railway financing already established in several states is likely to be made a Federal matter, now that the war experience has made a precedent. The domination of Wall Street influence in railway management is distrusted by the public; and its distrust is justified by such scandals as those of the New Haven and the St. Louis & San Francisco—to mention only two out of many. There will surely be, therefore, a much more rigid Government control of railway company financing, if the roads are turned back to the companies.

In the third place, there looms up the railway labor question. The railway employees' organizations are here to stay. Nobody doubts that. History was made when they won their battle and dictated their terms of settlement in the fall of 1916. They are going to have a very large voice in determining their own wages and working conditions. The methods by which the railway companies have controlled the labor situation in the past are not going to succeed in the future. In short, whether the companies operate the roads again or Government operation prevails, the final decision on railway wages will be made by some Federal board.

The public is now paying something like $750,000,000 a year in increased fares and freights to enable the railways to pay out this amount in increased wages to employees. Probably this is a just and fair increase in view of the changed value of the dollar; but the question is, How far will extend the power of railway labor to exercise its control at the expense of the public?

A railway officer of long experience remarked a half dozen years ago: "I once thought I earned my salary by using my technical knowledge and executive ability to run the lines under my control economically and safely; but I have now become a mere clerk to execute the orders of others. The railway organizations dictate what wages shall be paid and the conditions under which the men shall work. I have to hire the men they furnish and can discipline or discharge only as they approve. The Federal and state commissions prescribe what train service I shall furnish, what rates I shall charge for passengers and freight, how I shall keep my books and records, what measures I shall use to secure safety at every point, from the spikes in the track to the hand-holds on a freight car. I go through my daily routine; but as for any opportunity of exercising executive ability, originality or initiative, there is little to choose between me and the office boy."

There are many strong arguments in favor of operation of the railways by private companies, but many of these arguments are based on conditions which have prevailed in the past and which have offered opportunity for the men of enterprise and ability who have developed our railways to an efficiency undreamed of a generation ago. Undoubtedly, we need, as much as ever, such men in the railway business; but the serious question to consider is whether, with competition eliminated, with public control exercised at every point, and with railway labor in a position to dictate its own terms, both incentive and opportunity for creating efficiency in railway operation are not largely removed.

There are unquestionably powerful arguments against operation of railways by the Government. They are familiar to our readers. Pernaps Director General McAdoo had these in mind when he expressed his belief that the five-year trial of Government operation which he recommends would not result in its adoption as a permanent policy.

Replacing Distrust in Contractors by Confidence

CONTRACTORS should see to it through their new national organization, said General Marshall in addressing the first national convention of the body in Chicago last month, that never again should a contract be drawn within the four corners of which could be written the contractor's bankruptcy. The significance of this statement did not escape those present, everyone of whom undoubtedly had suffered from the kind of contract to which the general referred. But even contractors do not always appreciate the full extent of the evil consequences of one-sided contract agreements. The agreement which assumes on its face that one of the contracting parties does not intend to perform his part, if it can be avoided, does more than work a hardship on the individual who accepts such conditions. It lets into the contracting field men with whom it is safe to deal only on the assumption that they must be watched. Worse; it lets in men whose intentions are honest, but whose competence is doubtful. In other words, so long as no contractor is deemed worthy of confidence, so long as private owners and public bodies choose to assume that it is necessary to spy on any contractor they may select, to plan and supervise his work, and to perform things within the province of the contractor—to make sure that they are done as desired—so long will owners be willing to entrust their work to the lowest bidder regardless of ability, and so long will experience and real capacity to handle work go without proper reward.

Individually, a single contractor may build up a reputation for capability which will keep him well supplied with work for owners who have confidence in him. But at the present time work for private owners offers the only opportunity of this sort, and as a relatively small part of the total work is in the hands of large operators whose construction goes on year after year, the opportunity for establishing such a clientèle is further limited. The average owner does not build extensively as often as once in a decade, and comes into the market for contractors' services prepared to take things as he finds them and to treat the contractor as incompetent and dishonest because he finds the public doing likewise.

Collectively, contractors can eradicate this distrust, and replace it with confidence on all work, within a short space of time. Having a national organization, they can make an early beginning by getting the members to leave alone that work on which the owners offer agreements which do not repose confidence in the contractor. With the strength of such an organization behind the movement, a natural separation between the real contractor and the man who ought not to be in the business will result. The competent men will join the na-

tional organization and back it, in order to have a chance to handle the kind of work on which ability is recognized and paid for. The public and other owners who cannot or will not evaluate ability and experience in letting work will find no one of reputation offering to undertake their projects. The final result will be the elimination of those who ought not to be in the field, and the recognition by the public and all other owners that skill and capacity must be paid for in construction work, just as in other lines of business.

National Highway System Gets Strong Backing

LAST week the Highway Congress at Chicago fully bore out the predictions that it would serve to crystallize the highway sentiment of the country. After attending the meetings no one could doubt that the country at large, as represented by delegates from practically every state, was determined that our present highway systems should be completed by the adoption of a national system under the auspices of the Federal Government.

The congress itself declared in favor of a national system of highways to be built, maintained and controlled by the Federal Government, the system to be in charge of a national highway commission which would not only assume the new activities but take over all Federal highway functions.

The American Association of State Highway Officials, on the other hand, while one of the joint sponsors for the congress, did not accept the resolutions of the larger body, though its resolutions differ only in detail. Like the congress, the association advocated increased appropriations by the Federal Government, and favored a Federal highway system. The point of departure came in connection with the expenditure of funds. While the congress asked for a system built and maintained exclusively by the national Government, the officials favored the making of all expenditures under the Federal-aid plan, the routes in the Federal system being selected by the various states and connected at the state lines by the Federal department in cases where connections are not made by adjoining states.

With reference to the machinery of control by the Federal Government, the departure again was in detail. The congress declared unreservedly for a national highway commission. The officials' association, in its own meetings, recognized the inadequacy of the present machinery, and directed its executive committee to formulate and submit to the various state departments for their consideration a bill providing "for a Federal body or officer with adequate power and funds to administer all Federal and Federal-aid laws."

The differences of opinion—far from weakening the main proposals, those for additional Federal funds for highway work and the construction of a national highway system—tend rather to emphasize the unity of all highway interests on these broad matters. But the unanimity, nationally, goes even farther than the action at Chicago indicates. The Bureau of Public Roads brought to Chicago a bill proposing greatly increased highway expenditures by the Federal Government (totaling $425,000,000 in four years) under the Federal-aid plan, while it is now well known that in addition to this bill the bureau also carefully studied, drew up and considered a bill for a national highway system to be built and maintained solely by Federal funds. Even though the latter bill has apparently been rejected in favor of a measure for additional Federal-aid funds, it indicates clearly the drift; the Bureau of Public Roads, the most conservative body in the country on highway policy, never before was willing to give consideration to a policy of national highway building.

The so-called Page bill, brought to Chicago, which provides for increased Federal-aid money, has already been introduced by Senator Swanson, while a measure in accord with resolutions of the Highway Congress will undoubtedly be introduced in the very near future. Unless Congress sees fit to fly against the sentiment of the country, one or other of these measures will become law. It is our earnest hope that that which provides for the establishment of a national highway commission and a system of roads built and maintained exclusively with Federal funds will prevail. We refer to an article elsewhere in this issue, by the editor of *Engineering News-Record*, for arguments in favor of this plan.

Should the other measure, however, be adopted, it is inevitable, in our judgment, that before long the scheme will be changed. We cannot conceive that Congress will allow so large a sum as $425,000,000 to be expended upon a system that shall be determined by the individual states, for such determination is sure to result in an illogical system. However, if the state authorities give up their initative to the extent required to produce a defensible system of highway routes, they and the people of their states will not be long willing to pay half of the cost for that which is determined with sole reference to the nation's good rather than to that of the citizens of the individual state.

As to the method of Federal control, we feel that that, too, can have but one satisfactory solution—an independent body divorced from departments with alien interests. No other scheme is adequate to deal with the highway problems of the present day. In this respect, also, the departure of the state highway officials in their resolutions from those of the congress strengthens the latter's proposal rather than weakens it. The officials recognized clearly the inadequacy of the present administration, and directed their executive committee to draw up a bill conferring adequate powers.

From every point of view, therefore, the Highway Congress at Chicago has written highway history. That it was a correct interpretation of the views of the country is evidenced by the indorsement of the major propositions by a body which chose to dissent upon details. Undoubtedly, the energy and enthusiasm shown at Chicago will be carried through the various channels represented—highway associations, chambers of commerce and various civic bodies—to the members of Congress. With the Secretary of Agriculture, and even the President, favoring additional highway appropriations, open-minded as to the plan under which the moneys shall be spent, we are sure to have legislation in a very short time that will inaugurate a Federal system of roads adequate to the highway transportation demands of the present day.

Regulation of Speed, Weight, Width and Height of Motor Trucks Discussed

They Are Essential Transportation Agencies, and While Regulation Is Necessary It Should Not Restrict Their Expansion—Table of Proposed Dimensions, Speeds, Weights and Fees Presented

By George M. Graham
Chairman National Motor-Truck Committee of the National Automobile Chamber of Commerce
(From paper read before the Joint Highway Congress, Chicago, Dec. 12, 1918)

I ASK your consideration for my client, the motor truck. He is charged at divers times and places with wreaking damage untold upon our highways. He has cracked open the surface, he has pitted deep ruts, he has broken cavernous holes into which the rains have beaten, and collapse has followed. This is the bad side, but there are extenuating circumstances. It is admitted that he has done notable things for the country, performing almost incredible service in speeding up our war program. He has brought the manufacturer nearer his market, the farmer nearer his consumer, the finished war order nearer a shipping point. He has facilitated rapid filling of orders, brought in raw material, supplied the equivalent of man-power lost by withdrawal of soldiers, made less serious the shortage of horses, and restored in organizations gaps occasioned by deficiencies of labor, material and transportation.

Through rural motor-truck express farmers, produce growers and dairymen are reaching their markets. Fertile soil, formerly isolated, has been brought into access to the markets.

Motor trucks have been doing railroad work on short hauls. Public utilities companies, such as oil purveyors, telephone and telegraph companies and express companies, would operate under serious handicaps but for the assistance of the motor trucks. This is what my client has done on the good side.

Justice for the Motor Truck

But there are those who would banish him, because he has damaged roads which were never suited to his use. He has not offended maliciously. His misdeeds have proceeded from the fact that he has height, width, weight and speed, particularly weight and speed. We admit that he has these attributes. He could not very well get along without them, but in spite of the trouble in which they have involved him, we believe that this is an ideal time to define the place for the truck and to ask justice in his behalf.

We believe the truck as much sinned against as sinning. Out of 2,500,000 miles of highways in the United States not more than 10% are improved, and many of these are of most mediocre quality. The unfitness of the road has not only resulted in damage to the highways but has also militated against the efficiency of the truck, as has been shown by many tests.

There is no riddle about building roads that can withstand truck traffic. This is proved by Wayne County, Michigan. There are 10,000 trucks licensed in Wayne County. These contribute an enormous amount of heavy traffic. Much of the war material from up-state cities, such as heavily laden trucks, tractors, ambulances, etc., from Flint, Pontiac and nearby cities, goes through Detroit on this cross-country trip to the seaboard. Despite this abnormal traffic, Wayne County roads are in good condition. They stay right because they are built right.

Three Sides to the Controversy

There are three main parties in the controversy with respect to motor trucks and their relation to the highways.

First, there are extremists who argue that all the truck has achieved for civilization does not compensate for its damage to the highways. Their only panacea is ruthlessly to legislate the power vehicle from the highways, penalize its operation with impossible license fees, and ignore all the blessings to be gained from a new system of transportation which has taken its place with railroads and steamships.

Second come those of us who stand to defend the motor truck, who are willing that it should bear a proper financial penalty for such damage as it does to the roads, and who are willing to deal in a spirit of compromise with the question of weight and speed, so as to make these factors as little harmful to the road as may be.

Between these radicals is a third class, which stands for compromise. These concede the place of the truck and believe that roads should be built adequate for it. But they insist that, until better roads are obtainable, the present highways must be protected, even though in the process it becomes necessary to impose restrictions on trucks.

My presentation will, therefore, direct itself to drawing into closest possible accord the three viewpoints.

Highways the Servant of Transportation

As a basic proposition we beg to submit that highways should be the servant of transportation, not its master. The truck has made its place. It has proved its adaptability to modern transportation problems. Civilization will lose unless means be found for its expanding application. Restrictions, prejudices and petty objections must not be permitted to stand in its way, for it presents possibilities that are too great to be sidetracked for temporary considerations.

Those who admit no place for the truck stand opposed to the spirit of the times. They are putting themselves in opposition to cabinet officers, the Railroad Administration, the Food Administration, the War Industries Board, the National Highways Council, the Electric Railways' War Board, the Army, the United States Senate, and even the President of the United States, all of whom have approved of and coöperated with the efforts of the Highways Transport Committee to divert all possible traffic to the highways. Secretary Redfield has

definitely stated that legislation restricting the size of motor trucks is a menace to the development of highways transportation, and constitutes an economic error.

Those legislators who vote against trucks feeling that they are serving the interest of the farmer, should be reminded that actually they are working against the pocketbook of the farmer. It is a fact not yet generally known that haulage of farm product by motor truck is cheaper than haulage by team, as shown by the following table presented by Frank Andrews of the Bureau of Crop Estimates, of the Department of Agriculture:

COST OF HAULAGE PER TON MILE

	Horse and team	Truck
Wheat	$0.30	$0.15
Corn	0.33	0.15
Cotton	0.48	0.16

Must Protect Present Roads

For those who ask that trucks be not permitted to ruin present roads pending the time when money, labor and material can be raised to build new ones, we can have only highest respect. They are striving to guard that which is. We feel sure that they will be our allies against legislation that is unfair. We meet them in a spirit of coöperation.

As manufacturers we know that we must build trucks to weight, speed and size that will do least harm to present roads. The foremost men of the industry, recognizing the difficulties involved, have given close thought to the question of dimensions. Frequent meetings have been held in Washington to discuss the subject in detail. Compromises and adjustments have been made, and we are now in agreement on a bill which we should like to see enacted into law by all the legislatures of the United States.

It was high time for such concerted action, and we wish to propose a combination of necessary fundamentals, equitable legislation, efficient administration and proper construction.

It is entirely possible that after the war short-line railroads will be a thing of the past, not only because the motor truck can deliver goods over short hauls in quicker time and at a reduced shipping rate, but because it saves labor and time by delivering goods to the consignee's door. Add to this the fact that there is no initial expense in putting a line of motor trucks in operation outside of the original cost of the trucks, as compared with the high cost of track building and railroad equipment.

Lack of Repair, Not Trucks, Responsible For Condition of Roads

I should like to raise the question of how far trucks are responsible for the present damaged condition of the roads. Are they unjustly accused in this respect? It is conceded that roads were never in worse shape, that many highways formerly famed for their perfection are now battered and filled with ruts and holes. But is this up to the trucks? A foremost expert on road building and maintenance makes the statement:

"Since the war started we have not been able to make repairs. Labor has been lacking, and there have been embargoes on road-building material. Where formerly in the spring we would have quickly filled the holes and patched the ruts, we have been unable to do so. Therefore, the roads have been permitted to remain smashed up. Once our maintenance system is restored, we shall be able to do away with a lot of the present trouble. But for the lack of this repair the present agitation against trucks never would have arisen."

In our investigation we have found the opinion almost general that most of the damage is done in the spring. Then the frost is still in the ground, and as it thaws the mixture becomes almost like jelly. The impact of the passing vehicle with the top crust of the road, unsupported as the latter is by any adequate foundation, results in more damage than could be inflicted in all the other months of the year put together. We admit this fact unhesitatingly. We have in our bill proposed a remedy for it in the shape of an embargo by which, on proper notice, any road can be closed to traffic by the local highway authorities for any vehicle weighing more than 10,000 lb. Such embargoes cannot cover more than 45 days in any one year.

Proposed Dimensions For Trucks

Height and width are not the major problems with which we must deal. They can speedily be eliminated. We have fixed on 12½ ft. as the utmost distance between the road and the summit of the body, and 8 ft. as the greatest width of the body. We do not think these figures should be exceeded, and would cheerfully bow to laws so decreeing. Thus we readily dispose of height and width, but when we come to weight and speed we have much more to contend with.

It is not to be denied that the heavily weighted truck, running on solid tires and at high speed, causes damage. But it is not to be forgotten that both this weight and speed serve a highly practical purpose—the cost of carrying the load decreases in proportion to the number of tons carried.

As a general proposition it may be stated that as the size of the truck increases the cost of operation in relation to carrying capacity decreases. There are four principal reasons for this: (1) The cost of manufacture of a truck does not increase in proportion to the carrying capacity; (2) the so-called fixed charge, or overhead of operation, does not increase in proportion to carrying capacity; (3) the actual operation cost does not increase in proportion to carrying capacity; (4) the weight of the truck itself does not increase in proportion to carrying capacity.

From an economic standpoint this is most important. Truck owners have a right to operate their trucks to the highest limit of economy and efficiency. They should be permitted to run the heaviest possible truck made necessary by their haulage problems, and roads should be made equal to the burden as speedily as possible. To take any other position is to legislate directly against an increasing army of motor-truck users.

There are not less than 550,000 trucks in use in the United States. It has been estimated that farmers alone will apply to the highways 2,000,000 more trucks within the next 10 years. The possibilities in all other lines of activity are so many and so varied that the whole subject of truck legislation must be approached with justice and vision.

Our plan for a uniform truck law calls for permission

to operate a vehicle whose gross load is 28,000 lb. It also provides that the highway commissioner can reduce this limit to 24,000 lb., where it can be shown that the roads will not stand more than this weight. He also has the option of increasing above 28,000 lb., where highly improved roads make this possible.

The accompanying table provides for license fees, three kinds of speed according to section traversed, maximum weight and the load per inch width of tire. With the considerations of license fees I have not to do. Another speaker will discuss those. The load per inch width of tire was, after due consideration, fixed at 800 lb. throughout, whether solid or pneumatic tires be used. The speed and fees vary as the total load.

An examination of the weight of vehicles made by some 40 manufacturers shows that within the 4000-lb. class will fall vehicles rated to carry ½-ton and ¾-ton loads; 8000-lb. class, 1- and 1½-ton loads; 12,000-lb. class, 2-ton loads; 16,000-lb. class, 3- and 3½-ton loads; 20,000-lb. class, 4- and 4½-ton loads; 24,000-lb class, 5-ton loads, and within the 28,000-lb. class, 6- and 7-ton loads.

Overloading Made A Misdemeanor

If it be said that the maximum weight should be put to as low a point as possible in order to deal with probable overloading, attention should be directed to the penalty prescribed in the bill—a penalty made the more easy of infliction since the bill provides for a plate placed on the truck, said plate to show gross weight of vehicle and load. Any truck carrying more than this weight becomes liable to the penalty.

Therefore, the question becomes one of proper administration.

Truck Economical in Use of Steel

The war has made opposition to waste a national policy. It should, therefore, be remembered that the motor truck is highly economical in its consumption of steel, as compared to its carrying capacity. The steel required for the average railroad freight car is 25 tons; for the average locomotive and its tender 150 more tons must be allotted. A two-ton motor truck requires 1½ tons.

The ton-mileage of a freight car per day is 800, forty tons average load and 20 miles per day. An easy average for the two-ton motor truck is 200 ton-miles, two-ton load and 100 miles per day. Therefore, the four 2-ton trucks can do more work per day than one freight car. Trucks also deliver direct from shipper to consignee.

To build 50,000 steel freight cars and the 1250 locomotives to draw them will require 1,437,000 tons of steel. Only 300,000 tons of steel are necessary to build 200,000

DIMENSIONS, WEIGHTS, SPEEDS AND FEES SUGGESTED FOR PROPOSED UNIFORM TRAFFIC LAW

Character of Vehicle			License Fees		Maximum Speeds			
Reference Letter	Type of Tires, Etc.	Maximum Weight of Vehicle and Load	Covering all Charges, Including Property Taxes	Covering All Charges Except Property Taxes	In Open Country* Miles	Through Suburban Sections, Villages and Towns, Miles	In Thickly Built up Parts of Cities and Towns, Miles	Load per Inch Width of Tire, Measured between Flanges, Lb.
			Per Horsepower					
A	Passenger or light commercial, pneumatic tires	6,000	$0.60	$0.40	30	20	15	800
			Per Annum					
B	Other pneumatic tired	6,000	30.00	15.00	25	20	15	800
B	Other pneumatic tired	8,000	45.00	22.50	25	20	15	800
B	Other pneumatic tired	12,000	60.00	30.00	25	20	15	800
B	Other pneumatic tired	16,000	75.00	37.50	25	20	15	800
B	Other pneumatic tired	20,000	90.00	45.00	25	20	15	800
B	Other pneumatic tired	24,000	105.00	52.50	25	20	15	800
B	Other pneumatic tired	28,000	120.00	60.00	25	20	15	800
C	Having solid rubber tires	4,000	40.00	20.00	25	20	15	800
C	Having solid rubber tires	8,000	60.00	30.00	20	18	12	800
C	Having solid rubber tires	12,000	80.00	40.00	18	15	12	800
C	Having solid rubber tires	16,000	100.00	50.00	16	15	12	800
C	Having solid rubber tires	20,000	120.00	60.00	15	15	12	800
C	Having solid rubber tires	24,000	140.00	70.00	15	15	12	800
C	Having solid rubber tires	28,000	160.00	80.00	15	15	12	800
			Per Horsepower					
D	Commercial passenger	6,000	1.60	80	30	20	15	800
			Per Annum					
D	Commercial passenger	7,000	40.00	20.00	30	20	12	800
D	Commercial passenger	8,000	50.00	25.00	25	20	12	800
E	Motorcycles		10.00	5.00	30	20	15	
E	Motorcycles, side car		6.00	3.00				
F	Trailers or semi-trailers, with solid rubber tires	4,000	20.00	10.00				800
F	Trailers or semi-trailers, with solid rubber tires	8,000	30.00	15.00				800
F	Trailers or semi-trailers with solid rubber tires	12,000	40.00	20.00				800
F	Trailers or semi-trailers with solid rubber tires	16,000	50.00	25.00				800
F	Trailers or semi-trailers with solid rubber tires	20,000	60.00	30.00				800
F	Trailers or semi-trailers with solid rubber tires	24,000	70.00	35.00				800
F	Trailers or semi-trailers with solid rubber tires	28,000	80.00	40.00				800
F	Same with iron tires				Double the above rate for Class E.			
F	Same with pneumatic tires				Three-quarters of the above rate for Class F.			
G	Traction engines, tractors, etc., not loaded		30.00	25.00				
H	Electric				Two-thirds of the fee charged gasoline vehicles of equal weight			
I	Animal drawn			1.00	For one horse or its equal, 800 lb.			
I	Animal drawn			2.00	For two horses or their equal, 800 lb.			
I	Animal drawn			4.00	For four horses or their equal, 800 lb.			
I	Animal drawn			6.00	For six horses or their equal, 800 lb.			
I	Animal drawn			8.00	For 8 horses or their equal, 800 lb.			
I	Animal drawn			12.00	For 12 horses or their equal, 800 lb.			
J	Publicly owned				No charge; maximum speed, maximum weight and load per inch width of tire to govern each similar class of vehicle, as prescribed in Classes A, B, C, F and K.			
K	Registration tags or markers issued to manufacturers and dealers in motor vehicles or trailers			25.00	For first two sets—$12 for each additional set.			
L	Registration tags or markers issued to manufacturers and dealers in motorcycles			20.00	For first two sets—$5 for each additional set.			
M	Chauffeurs' licenses			2.00				
M	Operators' licenses			2.00	For operators, good until revoked.			
N	Duplicate licenses			.50	For each duplicate set.			

* Greater speeds may be attained for distances not to exceed ¼ mile, in order to permit one vehicle to pass another.

two-ton trucks capable of doing the same amount of work. There is a saving of 1,137,000 tons of steel.

Considered from the standpoint of national wealth and prosperity, does not this saving, plus the time saving in favor of motor trucks, make insignificant the cost of repairing possible damage to the roads?

An Ideal Plan

As a temporary measure, the ideal plan would seem to be to build improved roads on the shortest routes connecting important centers, and then to protect these roads from washouts, cave-ins and obstructions caused by snow and ice.

As far as possible, traffic should then be centralized temporarily on such designated routes, thereby eliminating the necessity of sending trucks over side roads, before they have been properly rebuilt for such traffic. Such well organized motor-truck highways, by obtaining the shortest routes and skirting the congested districts, would be valuable savers of time.

There are three principal methods of finance by which may be obtained roads that will afford the truck its full chance of service to the public: (1) Direct taxation on part of the state; (2) enlarged Federal aid, based on the probability that the war's end will see the United States Government owning a large number of motor trucks, which will be applied to peace uses in the various departments. There is already keen Governmental interest in respect to the highways situation, and there are better chances of assistance here than ever before; (3) there never was so great a warrant [state?] for bond issues as now. Previously, projects of bond issues for highways construction met the objection that future generations should not be taxed with the burden of financing new constructions. This reason does not hold valid now. The present generation has done its duty by posterity. It has borne not only the burden of death and suffering from the war, but also assumed more than its share of the financial obligation. Therefore, it is only equity that generations to come should pay their share for inaugurating adequate road systems now. Results in Illinois and Pennsylvania would indicate that the public is coming to this same viewpoint.

When we obtain roads suited to truck traffic, license fees should always be maintained at such figures as will permit the maintenance of the highways without further burden to the public.

I submit you the case of my client. I hope you will not be unduly severe on him for such damage as he has wrought. We ask you to coöperate with us in our effort to make the road fit the truck and the truck fit the road, for the permanent benefit of us all.

A Suggested National Highway Policy and Plan

Phenomenal Growth of Interstate Motor Traffic, Favorable Attitude of Government and People, and Magnitude of Problem Make Suggestion Timely

By E. J. Mehren
Editor of Engineering News-Record
(Paper read before Joint Highway Congress at Chicago, Dec. 11, 1918).

TEN years ago the highways of this country were subjected to a traffic scarcely different from that which they had borne in Revolutionary days. In fact, the traffic was not much different from that which the Romans had imposed on their roads nineteen centuries ago. Indeed, highway transportation has changed to a greater extent in the past 10 years than it did in all the nineteen hundred years preceding. The motor vehicle is responsible for this revolution in conveyance, and to it is due the stress to which our roads are subjected.

Growth of Motor-Vehicle Traffic

A decade ago the automobile was in its infancy. Today 5,500,000 motor vehicles are in service, and of these it is estimated that 500,000 are commercial cars, ranging from the light delivery wagons to heavy trucks. Figures have not been compiled as to the number of passenger miles totaled in automobiles every year, nor as to the ton-mileage of freight hauled. H. W. Perry, secretary of the Commercial Vehicle and Good Roads Committee of the National Automobile Chamber of Commerce, made an estimate in 1916, however, that gives ground for an interesting comparison. There were in use then 3,000,000 passenger automobiles. Allowing an average of 5000 miles per year per car, and assuming an average number of passengers per car as three, he obtained a passenger mileage per year of 45,000,000,000. Since that time the number of passenger automobiles in use has increased to 5,000,000, and, even if we discount Mr. Perry's figures heavily and accept, with the larger number of cars in use, his total of passenger miles, 45,000,000,000, we still find that the figure exceeds that for the railways of the United States in the year 1916, which was 34,000,000,000 passenger-miles. In the same estimate, published in *Engineering Record* of Jan. 20, 1917, p. 112, Mr. Perry concludes that the commercial motor vehicles of the country performed a service of 3,750,000,000 ton-miles when there were 250,000 commercial vehicles in use. He assumed an average of 50 miles per day, 300 working days per year, and two tons per load, with half the mileage traveled loaded. This appears to be a very liberal estimate, but if his figure is twice as large as the facts, the traffic would now, with a doubling of the number of commercial cars, have caught up to his estimate, and surely a freight traffic of 3,750,000,000 tons is not a negligible item.

It is not now possible to ascertain what percentage of this passenger and freight mileage was carried over rural roads and what portion over city streets. The figures are quoted merely to give an idea of the magnitude of the instrumentality—the motor vehicle—which has introduced the new and troublesome factor into highway construction and maintenance, and has raised highways into one of the foremost of national problems.

Another measure of the new importance of highway transportation is indicated by the total annual expenditure for highway work. The Bureau of Public Roads gives the cash expenditure on highways for the year 1915 as $267,000,000. This already large sum is sure to be rapidly increased because of the attitude on highway improvement in every part of the country. It is hardly necessary to call attention to the fact that the two $50,000,000 bond issues authorized in New York State have now been followed by a $50,000,000 authorization in Pennsylvania, and a $60,000,000 authorization in Illinois.

The Government's Attitude

The figures, then, as to the number of motor vehicles in use, and the expenditures on highways, confirm our opinion as to the importance of the highway transportation problem. If we seek further confirmation we can find it in the attitude of the Federal Government. The Bureau of Public Roads, which surely cannot be charged with anything but the utmost conservatism, was established in 1893. Its appropriations have grown year by year to a total of $400,000 annually, exclusive of that portion of the Federal-aid funds which is used for administration purposes. In other words, the United States Government, following an exceedingly conservative policy, has gradually increased its expenditures for purely advisory and experimental work to $400,000 per annum.

But this is not all. In July, 1916, the Federal-aid law, carrying a total appropriation of $85,000,000, to be expended over a period of five years, was passed. This law, marking a great stride forward in our highway policy and constituting the first step toward a national highway system, is in itself merely the culmination of a movement that has been going on for a quarter of a century. We determined years ago that township administration of roads was unsatisfactory even for horse-drawn traffic, and county supervision of highways was inaugurated. But even county administration proved inadequate, and in order to meet the new demands of traffic state after state has taken over supervision of its main trunk lines. In some states the commonwealth's money is contributed to aid county work, while in others the state builds and maintains with its own funds the main highway routes. From that stage of our development, state control, the logical step was assistance by the Federal Government to the states themselves.

The question now comes whether another step should not be taken, in order that we may round out and complete our highway development. I need not tell highway builders and highway users that sentiment has been growing all over the country in favor of the construction and maintenance by the Federal Government of a highway system that shall transcend state bounds and that shall do nationally what state control has done within state borders—place the through routes under a single competent authority.

Secretary of Agriculture Advocates Increased Federal-Aid

It is opportune here to quote no less important a man than the Secretary of Agriculture, who supervises generally the Government's work in highway matters. In a statement given to the press Nov. 27, he discusses the highway funds available from state and Federal appropriations, and then adds these significant words: "Still, it seems to me that we should take a further step; it would be in the public interest to make available larger appropriations from the Federal treasury, to be used separately or in conjunction with state and local support."

Let me call your attention to the very significant word "separately" in this statement of the Secretary. A system built and maintained separately by the Federal Government means a national system of highways. Note that the Secretary does not commit himself to that system. He does, however, place it on a par with the Federal-aid plan.

This is the first statement from the executive department of the Federal Government that it is prepared to consider the expenditure of Federal funds for a system of highways to be built and maintained solely at Federal expense. Furthermore, Secretary Houston says in his statement that he has taken up his suggestions with the President, the Secretary of War and the Postmaster General, and that they agree with him that the appropriation of additional moneys is advisable. I have it on good authority that the Secretary discussed not merely additional revenues, but the possibility of their expenditure for a national system, and found that the President and his fellow cabinet members were not opposed thereto. And I say this, even though a recent letter from the President to Secretary Houston discussing additional expenditures referred only to the Federal-aid plan.

Lessons Taught by the War

In indicating their openmindedness with respect to the building of national highways, the officers of the administration indicate that, in common with the public, they have learned the lessons which the war has taught regarding the place of the highways in the transportation system of the nation. Personally, I am glad that the statement of Secretary Houston has come at this time, for it gives support to that which I had proposed three months ago to present to you today—a plea for the adoption by the United States Government of a new policy in highway work, a plea for a further and completing step in our highway progress—namely, the selection, construction and maintenance by the Federal Government of a national highway system that shall fully embrace the entire country, that shall serve every state, that shall tie the nation together by a network of highways more effective in its place than even the rail lines which form our secondary system of transportation.

The step proposed is an important one. What are the reasons for the building of a national highway system? I contend that the policy should be inaugurated for (1) economic reasons; (2) spiritual reasons; (3) military reasons, and (4) because of the example it would afford for all classes of highway construction. Let me say here that the people of this country will not find it necessary to make a close study of the various factors as we, with a deep interest in highways, shall naturally make. There is something sure and solid in sweeps of public opinion that proceed slowly and in which each step is logical, following upon its prede-

cessor. I have taken the trouble to inquire as to the attitude of the people from coast to coast with reference to a national highway system, and find that the war injected the necessary crystallizing element to convince the people of this country, far and wide, that highway systems cramped by state lines are insufficient for the demands of the present day. And when the people at large favor a policy, particularly when it is not radical, but is a logical development from an existing situation, we may feel sure that its realization is not far distant.

The economic grounds which justify the inauguration of a national highway system are based upon the extent to which motor-truck traffic has developed. We had evidence of its importance last winter, when many industries were kept in service because they were able to get essential materials and coal by motor truck after the railroad system had broken down.

Motor-Truck Traffic Over Rural Roads

Moreover, the economic importance of highways is indicated by the extent of the motor traffic running over the rural roads.

As an instance of the extent of this truck traffic, it is of interest to know that the Return Loads Bureau of the New York Merchants' Association lists no less than 661 motor trucks which are registered to go over either specified routes or are available for carriage anywhere. The established motor-truck routes cover no less than 1721 miles of highway, including such runs as from New York to Boston, New York to Syracuse, New York to Scranton and New York to Washington. There are, of course, in addition, many routes ranging up to 100 miles in length, and simply scores of systems which reach the suburban towns in Connecticut, Long Island, Westchester County and northern New Jersey. These are not included in the 1721-mile total just mentioned. What the total number of trucks is that radiate from New York and run on rural highways has not been recorded. If 661 are registered, however, it is safe to say that three or four times that number are engaged in traffic over rural routes.

In connection with this trucking in the neighborhood of New York, it is important to note the extent to which the registered vehicles cut across state lines. The established routes go into or across the States of Massachusetts, Rhode Island, Connecticut, New Jersey, Pennsylvania, Delaware and Maryland and the District of Columbia. In other words, the motor truck, not to speak of the passenger car, has become an instrument of interstate commerce of no mean proportions.

Furthermore, consider the inequities that are possible under the present system of obliging the states to bear the burden of their highway developments, save as they may get some assistance under the Federal-aid law. The traffic between New York and Philadelphia has grown to be of tremendous proportions. For a great part of its length, the New York-Philadelphia route lies across the State of New Jersey. The heaviest share of the highway portion of the trucking cost comes out of the pockets of the New Jersey taxpayers.

What is said of the motor-trucking situation at New York can be repeated, of course, for all of the large cities of the country, whether they be situated on the Atlantic or the Pacific, near the Canadian border or on the Gulf. Motor trucking over rural routes has become a very considerable factor in the lives of all large communities, and not infrequently enters very heavily into interstate commerce.

In further reference to the interstate character of motor trucking I need merely ask you to revert momentarily to the remarkable address by the Hon. James I. Blakslee, fourth assistant postmaster general, at this morning's session. He has parcel-post routes in service at the present time across state lines, and is planning a very considerable extension of the system. What the benefits of such parcel-post routes are to rural communities in bringing goods to their doors, and in furnishing quick and regular transportation of their products to the cities; and again, what these routes mean to city dwellers in bringing them quickly and cheaply the products of the farm, I leave to his very graphic description and to your own knowledge of the present terrific transportation and middlemen's charges on fresh farm products. I can see no single movement that will so reduce the cost of living as the rapid extension of the parcel-post routes which Mr. Blakslee is now operating, and which he has planned. In fact, we could find adequate justification for a national highway system as a means for allowing him to proceed with his magnificent work, even if there were no other argument in its favor.

The Passenger Car in Interstate Traffic

The spiritual justification that I claim for a national system of highways is based on the extent to which passenger-car traffic has developed between the various states. There was a time when the passenger car was considered an agency for recreation only. We now see it in a different light, and realize that it is an important instrument of business.

Nevertheless, I am willing to claim justification for a very heavy expenditure by the Federal Government for highway construction solely on the basis of passenger-car travel for recreational purposes. On Labor Day of this year I stood just below Colonel Cody's grave, in the Denver Rocky Mountain Park, and watched hundreds of cars pass by on the road beneath. The majority of them carried Colorado licenses, but a goodly number showed the tags of Wyoming, Utah, Kansas, Nebraska, New Mexico and other trans-Mississippi states. I maintain that each of the cars that had come from another state into Colorado carried back men and women who were better citizens of our common Union, who had a better appreciation of the glory of our country and who were more firmly convinced than ever before that for the maintenance and defense of this nation, no sacrifice is too great. "Not by bread alone does man live." Spiritual forces are still the mainsprings of all great endeavor, and hold this nation together no less certainly than they did in the Revolutionary War or in the great war. We have had a wonderful demonstration during this war of the unity of our people. That unity was fostered and secured by the various agencies of transportation and intelligence which have wiped out sectional lines, and taught the East and the West that they are one, the North and the South that their aims are common. I am willing to dispute with any man who maintains that this spiritual unity in the United States is not worth spending money to secure.

What the extent of passenger automobile traffic is from state to state there is no means of knowing. Here and there, though, are figures which give some indication of its extent. There are, for example, the statistics of private-car travel in Yellowstone Park. No less than 17,000 persons traveled through the park in the season of 1918 in private automobiles. Naturally, the greatest number of these came in cars bearing the tags of states which border the park—Idaho, Montana and Wyoming. But 456 traveled in Colorado cars, 1854 in Utah cars, 648 in Washington, 152 in Illinois, 235 in Iowa, 300 in Kansas, 101 in Michigan, 224 in Minnesota, 206 in Missouri, 529 in Nebraska, 90 in Ohio and 61 in New York.

Additional light on the extent of interstate touring is shown by the activities of the Touring Bureau of the American Automobile Association in Washington, D. C. Between Sept. 15 and Nov. 26, of this year, no less than 400 autoists stopped at that office and inquired as to the best route to Florida. In the summer, the same office advises, an average of 20 persons per day inquire regarding routes to New England points, and four regarding routes to the Pacific coast. Where one person makes inquiry, 20 rely on guide books. These figures are for only one point, the City of Washington. Automobile clubs in every large city can bear similar testimony to the extent of interstate touring.

Reverting to my previous statement that it is worth the expenditure of considerable money by the Government to encourage touring, let me call your attention to the fact that the expenditures by the Government on the national parks for the fiscal year ending in June, 1918, amounted to somewhat more than $800,000. This department of the Government is spreading the slogan "See America First," and hopes by acquainting our people with the extent and wonders of our country to keep much of our tourists' money at home, promote healthful recreation, intensify faith in our country and develop a better appreciation of the value of citizenship.

Military Uses of Highways

The third reason I assert as justification for a national highway system is that of military necessity. The War Department has refused to designate any highways as military highways, but we have the testimony of leading Army officers that every highway connecting large centers is a military highway, in effect, during war times. All of the trunk lines leading into the big munition centers last year were military highways in effect, even though not so declared. We most sincerely hope that out of the peace conference shortly to be held in Paris there may come a league of nations, but even if there is that fortunate result, it will still be necessary for us to be prepared. No one will contend that even if a league of nations is formed, we shall abolish our War Department. And if we do not abolish it we cannot afford to neglect the most essential means of transport for fighters—the highway system.

We had an excellent demonstration of the possibilities of highways in war time when 18,000 Army motor trucks ran over our highways during the war, from the Great Lakes to the Atlantic seaboard. These routes, to be effective, must be under a single control, in order that the construction and maintenance may always be adequate to the demands of military traffic.

In addition to the benefits already emphasized, the building and maintenance of a national highway system will furnish an object lesson to the citizens of every state in the Union. It is true that under the Federal-aid system there is excellent opportunity for influence by the Federal Government upon highway construction and maintenance, but initiative lies with the states, and their views have great weight. Under the national system, however, the Federal Government would be unhampered in the selection of roadway surfacing, in the method of maintenance and in the control of traffic. In all of these respects the standards would be the highest warranted by present-day traffic conditions, and such routes, crossing every state in the Union, and coming under the personal observation of thousands of citizens, would set a standard for state and county road work and for traffic control that would be of inestimable value in the development of adequate local highway systems.

For these reasons, then—the extensive development of interstate highway transportation both of goods and passengers, and the ensuing spiritual and economic benefits to our country, as well as for the value of the example given—it is the speaker's judgment that it is both desirable and necessary that the Federal Government round out its highway policy by undertaking a national highway system which shall give us in a reasonable time Government-built, Government-maintained and Government-controlled trunk highways, consisting of all strategic routes and providing intercommunication between all the states.

Would Federal-Aid Extension Suffice?

Some will argue that there is no need for this additional step in Federal highway policy, but that everything desired can be accomplished under the Federal-aid plan. The best answer to such an objection is to canvass the opinions of the state highway engineers throughout the country. That I have taken the trouble to do, and I can assure you that the opinion is overwhelming that the Federal-aid system is inadequate to secure the building and proper maintenance of through trunk routes of a single high standard, conformable to the traffic that must be borne. Naturally, and very properly, each state is obligated to its citizens to spend its highway funds to the maximum benefit of the people of the state. Consequently, in selecting their Federal-aid projects, they will choose the routes that will be of greatest advantage under local conditions, and will not be interested in spending funds for links of less local importance. State highway engineers from all over the country tell of the futility of efforts of adjoining states to connect up their systems.

Let it be clearly understood, too, that in advocating the building of a national highway system the speaker does not believe that the present Federal-aid road plan should be abandoned. On the contrary, it is his belief that the expenditures under the Federal-aid plan should be materially increased. If we are justified in spending $100,000,000 a year in the building of a national highway system, we are at the same time assured of a generous return, economically and spiritually, from an expenditure of $25,000,000 annually under the Federal-aid plan.

Americans, when they see a real need, do not look for

precedents. Nevertheless, let me remind you that the countries of the old world have long had national highway systems. What the national road system did for France in the war need not be repeated in these days when the war memories are still fresh. But Spain and Italy, Austria and the individual kingdoms and principalities of Germany had state road systems. In all cases these were superimposed on the very excellent systems of the minor civil divisions. England has a state-aid system, but the flexibility of her thinking on the highway problem was shown during the war by the fact that the War Office appropriated money for the maintenance of highways subjected to heavy use by War-Office traffic.

Plan for National System

Manifestly, without very complete study it is not possible to indicate the routes that should be included in a national highway system. There needs to be a very careful survey for the determination of routes which will be of the greatest benefit to the country as a whole. In my judgment, however, the policy at the outset should include at least two highways per state, one approximately longitudinal (or east and west) and one approximately transverse (north and south). A rough study of a system so laid out will show that there would need to be five routes east and west, and ten north and south. Such a system would total somewhat less than 50,000 miles, or approximately 2% of the total road mileage of the country.

If the cost is figured at $25,000 per mile, which is liberal considering the condition of the roads which would be taken over, the total cost would be $1,250,000,000. This is a large sum, but in view of the heavy appropriations which we have made during the past two years for destructive purposes, and considering that the States of New York, Pennsylvania and Illinois alone have either bonded themselves or have voted to bond themselves for $210,000,000 for the construction of state systems, the sum is not unreasonable. If the money were appropriated at the rate of $100,000,000 a year, the total appropriation would have to extend over 12½ years. Surely, this is not a heavy strain upon the resources of a country which has raised over $15,000,000,000 in Liberty Loans in 18 months' time. Moreover, this expenditure is distinctly of a type that adds to the economic wealth of the country, by lessening transportation costs and increasing property values.

How shall the national highway system here proposed be administered? There is but one plan, in my judgment, adequate to the national importance of the highway problem, and that is through a national highway commission. In the past our Federal road bureau has been buried as a subordinate office in a great Governmental department, whose chief interest lies in another direction. It would be as logical for me to advocate the abolition of all state highway commissions and the putting of their work under the respective state departments of agriculture, as to advocate the continuance of the Bureau of Public Roads under the Department of Agriculture. Why have we separate and independent highway commissions in the various states, and not subordinate bureaus? Simply because the highway problem is of such importance as to demand the broad-gaged consideration and handling that only the dignity of a separate major arm of government can secure.

Let me quote you from the Good Roads' Year Book for 1917, p. 41: In the section on state highway department legislation, prepared under the direction of R. Walton Moore, chairman of the Committee on Legislation of the American Highway Association, we find this statement:

"In some states the (highway) department is managed by a single commissioner, and in others by a board of commissioners. The advantage of concentrating authority in a single commissioner is that a good administrator can accomplish more than a mediocre board, and it may not be so difficult to obtain a good administrator as it is to obtain a harmonious, energetic and capable board. On the other hand, a board composed in part of state officials and in part of civilians, including professors of engineering in state colleges, is perhaps more likely to be free from individual predilection, in closer touch with public opinion in different parts of the state, and apt to take a broad view of problems because relieved of direct responsibility for detail."

I submit that for a national system of highways we need, above all, that close touch with public opinion in different parts of the country and that broad view of problems coming from relief from direct responsibility for detail, which the Good Roads' Year Book so aptly says are advantages of the commission form of highway control.

Some will say that Congress will not appoint a highway commission. I submit that Congress will be glad to do that which the people of this country really want. In four years Congress has created no less than four important boards or commissions for peace-time purposes, and no end of boards for war-time purposes.

Of the peace-time boards there have been established in four years the Federal Reserve Board, the Federal Trade Commission, the United States Tariff Commission and the Federal Board for Vocational Education. The Tariff Commission was created as recently as September, 1916, and the Federal Board for Vocational Education in February, 1917.

What was the reason for the creation of each of these boards, or commissions? In every case it was because the problems had grown to be of such a magnitude that their broad-gaged consideration and administration could no longer be trusted for efficient handling to administration departments. In the opinion of Congress, the country could be better served by placing these functions in the hands of independent bodies than by leaving tariff considerations and trade matters to the Bureau of Commerce or vocational education to the Bureau of Education of the Department of the Interior.

Broad-Gaged Consideration Only From Separate National Highway Board

I submit that the highway problem has now come into the same class, and that it is of such national importance that broad-gaged consideration can be secured only by putting the problem in the hands of a separate board.

Some have argued that the creation of a national highway commission is dangerous because it will increase the centralization of control in Washington. That argument was strongly advanced in a meeting in

this city only yesterday, but would the speaker suggest the abandonment of our Federal judiciary system and the concentration of all legal matters in state courts? He would answer, "No; state courts for state cases, Federal courts for national cases." Would he abrogate the Sherman and the Clayton laws, abolish the Federal trade commission and confine all corporation legislation to the states? He would answer, "No; state laws for state corporate matters, national laws and national administration for those corporate matters which transcend state lines and are national in character." Would he advocate the abolition of the Interstate Commerce Commission and the control of all railroad matters by 48 state railroad commissions? He would say, "No; state railroad commissions for state railroad problems, interstate commerce commissions for national railroad problems." I think, too, that he would admit that there are highway problems which transcend state lines and are truly national in character. Following the logic of our Government's development, I contend that we should have state highway commissions for state highway problems and a national highway commission for national highway problems.

To sum up, then, I come to you with a plea that the United States Government shall take the final step in rounding out the highway system of the country, by superimposing upon our excellent county and state systems a national highway system, to be built, maintained and controlled by the national Government itself. In its effect upon the farmer, in its effect upon the cost of living, in its influence on national morale, no single transportation agency is as important as the highways, and I urge that the Federal Government, as the only agency capable of building and administering an adequate system, embark on this great project. It will return in increased property values, and in lower transportation costs, all that is invested in it, and it will contribute very materially to the further welding together of all the people of the country.

License Fees for Motor Vehicles and Drivers

Those Benefited Should Pay for Highways—Theory of Marginal Utility Indicates That Public Should Pay First Cost, While User Should Pay Maintenance

By H. Eltinge Breed
First Deputy Commissioner of Highways, New York State
(Paper read before the Joint Highway Congress, Chicago, Ill., Dec. 12, 1918)

After comparing the opposing theories that the entire cost of highway construction and maintenance should be paid by the user, on the one hand, and the general public, on the other, Mr. Breed, considering the advantages and disadvantages of both systems, takes intermediate ground. The cost of highway construction is great—so is the immediate benefit to the public. The cost of highway maintenance is great—so also is the damage done to the road by motor vehicles. The public and the user should each pay up to the margin of direct benefit to each, and the author believes that these margins are reached when the public pays for construction and the user pays for maintenance.—Editor.

THOSE who benefit from an improvement should be the ones to pay for it. Like many another obvious truth, that easy-sounding statement conceals the kernel of our perplexity. *Who* benefits by improved highways, and in what proportion? The question involves the economics of taxation; the various answers to it are as radically opposed.

They run the gamut from those who would place the entire cost of highway construction and maintenance upon the direct users of the roads, to those who would exempt them and make the general public foot the total bill. In between are the various degrees of compromise, all of them advocating, in different ratio, some tax on the public and some on the vehicles. To prepare the way for this middle group, let us briefly consider the arguments of the two extremes. Many of them appear in replies to a questionnaire that I sent to a number of state highway officials and to representatives of automobile associations and industries.

The strong plea for exempting the direct users of roads and placing the entire cost upon the public is, of course, that the public is ultimately the great beneficiary.

I may never own a car, or ride in one, but when my child is taken critically ill, his life may depend upon the condition of the good road over which the doctor can speed to him. Shall I hesitate to pay my share?

I may never have letters to send or goods to export, yet inevitably the life of my household and business depends upon the receipt of supplies from without. Shall I not help pay for the route over which they travel?

Even though I may never use the public schools I gladly pay the school tax, because through education it enhances the life of the community, and hence my own welfare.

I pay for police and fire protection, though personally I may never need either, and I don't demand that people whose houses burn up, or who have burglars arrested, shall pay a special fee. Should I not be willing, as one of the public, to pay for the public benefits derived from good roads, especially as I am bound to receive from them not only a share in the general good but direct personal advantages?

The argument sounds convincing. It is ably supported by George Diehl of the American Automobile Association.

An interesting suggestion for application of the entire tax upon the public is made by Ellis Dutton. Land bordering the highway, whose value is directly increased by it, shall carry the greatest burden of expense; contiguous lands and the general public should pay less, proportioned, as far as possible, upon the benefits they receive. Says Mr. Dutton: "In every case where streets or roads are paved the increased value of the property is more than the cost of the improvement. Shouldn't these benefited lands pay for the paving . . . and in less proportion contiguous lands and the general public?"

But, as in the case of so many other convincing arguments, there is a practical difficulty—not insuperable perhaps, but considerable. The traffic demands for and upon highways are greater than the taxpaying power of the public can sustain. More and more traffic—an increase in New York State of 390% in motor vehicles in the past seven years—more need for new routes and good maintenance; higher and higher taxes, until the point is reached where the increased cost of the roads does not yield the taxpayers a commensurate return in public benefits. The gain accrues to private pocketbooks. Thence we swing to the opposite extreme that says that the motor vehicles using the roads and directly profiting from them should be the ones to pay for them. I purposely omit horse-drawn traffic here, as being an increasingly negligible factor upon our highways.

Putting Entire Cost on the Motor Vehicl

Illinois is the chief exponent of taxing motor traffic for the entire cost of the highways.

The arguments advanced by Mr. Bradt of Illinois in favor of their arrangements are:

1. The practical difficulties of raising money through a general public tax. The political party in power, particularly in election year, is so anxious to keep down taxes that it is loath to secure funds for absolutely necessary work. The tax burden in Illinois is already very heavy.

2. The greatest benefits from the roads accrue to the direct users of them. Motorists gain directly through the lower cost of running on good roads. Hence, the user should pay.

3. The public really pays a share through the increased cost of service and commodities received over these highways.

On the strength of these arguments, Illinois has authorized bonds for $60,000,000 for highway improvement, all of which will be paid from automobile, dealers', motorcycle and chauffeurs' license fees, the greater part being derived from automobile fees. The system to be built from this sum will cover 4800 miles, and, it is estimated, will carry 40 to 50% of the total state traffic. It comprises, however, only 5% of the total road mileage. The other 95% will have to be maintained and improved through general taxation.

So even the state that has gone farthest in taxing vehicles for highway purposes has stopped short of the ultimate, by 95% in mileage and 50% in traffic.

The practical objections to putting the whole cost of the highways upon motor-car users are obvious. In the first place, even if it were practicable, it wouldn't work—which isn't quite so much of a bull as it sounds. It wouldn't work because all cars engaged in any kind of public service—by far the greater and more destructive number when you include the motor trucks—would immediately charge the expense of the fee to the cost of their service, increasing the price to the consumer, so that the public would be paying just the same, only a little more so, for the benefits it receives via the highway route. Indirect taxation may tickle the palate, but it's fundamentally bad for financial digestion. The relatively small number of car owners who do not perform any public service for which they charge would bear the brunt of disproportionately high taxation. This immediately raises the question of how far we believe in class taxation. Is it, or is it not, justifiable?

Moreover, I don't believe it is generally practicable to raise highway funds exclusively through taxation of vehicles. It would tend to limit the number of vehicles, and the fewer of these the more each one would have to pay, until the limit that any one could endure would be reached. Then the roads would have to suffer—less new construction, poorer maintenance—until the public, realizing that the loss of good roads was costing far more than the taxes necessary to sustain them, would rise and demand that they be continued.

Theory of Marginal Utility as a Working Basis

It is really the theory of marginal utility that adjusts the difference between the two extremes, and offers us a working basis. The public is willing to pay up to the margin where the utility it receives from the road compensates the money outlay in taxes. Beyond that it cannot economically go. But so great is the destruction of the roads under heavy traffic that taxes on this basis will not meet the entire cost of maintenance and desirable new construction. The difference must probably be met by a tax on vehicles. Now, the vehicles are willing to pay up to the margin where the tax levied upon them is commensurate with the especial value that they, as direct users, receive from the road, in distinction from the non-direct-using public. Believing, therefore, that both classes of beneficiaries should contribute toward the support of highways, it remains to adjust the balance between them.

The point of marginal utility for the public seems to be reached at paying for the construction of new roads. The cost of these is great; so is the immediate benefit derived by the public. More exactly than such balances can usually be made, the point of marginal utility for the vehicles seems to be reached at paying for maintenance. The cost of maintenance is great; so also is the damage done by motor vehicles to roads for which the public has paid. I make these two statements, *a priori*, from a study of cost data and of the means taken by the different states to raise the necessary funds for highway purposes. They are, of course, open to dispute. I offer them as a hypothesis, because motor-truck fees must be considered in relation to the objects for which they will be used.

If we consider the fees in relation to maintenance, Connecticut offers us some interesting experience. Mr. Bennett, the commissioner there, is working on the the-

ory that the income from motor fees should approach the outgo for maintenance. Here are the schedules of Connecticut's heaviest revenue producers in fees: For passenger cars, 50c. per horsepower per annum; for commercial vehicles up to 1000 lb., $11 per annum; one ton, $15 per annum; then an increase of $5 per half ton to the three-ton weight, $35; then an increase of $10 per half ton to the five-ton weight, $75; then an increase of $12.50 per half ton to the seven-ton weight, $125; 7½ tons, $150 per annum; eight tons, $200 per annum; then for each additional ton or a fraction over a ton, $100; each motor cycle, $2; each chauffeur or operator, $2.

Here are the schedules of New York's heaviest revenue producers in fees: Passenger cars, 25 hp., $5 per annum; 25 to 35 hp., $10 per annum; 35 to 50 hp., $15; 50 hp. or more, $25.

For commercial vehicles, two tons or less, $10 per annum; then an increase of $5 a ton up to 14 tons, which is $70; for each ton over 14, $10 per ton; for trailers of two tons or less, $5 per annum; two to five tons, $10; five to seven tons, $15; seven to 10 tons, $20; 10 to 14 tons, $30, and $5 for each ton above 14.

For passenger omnibuses:

Passengers	
Up to 5	$15.00
Not less than 6 nor more than 7	24.50
Not less than 8 nor more than 10	30.50
Not less than 11 nor more than 16	43.00
Not less than 17 nor more than 20	52.00
Not less than 21 nor more than 22	55.00
Not less than 23 nor more than 26	61.50
Not less than 27 nor more than 30	67.50

And an additional $2 for each passenger over thirty.

Motor cycles, $2.50; chauffeurs, $5 first year—$3 for license, $2 for examination; renewal, $2.

According to motor-car owners with whom I have talked, these fees are paid willingly, both as a matter of abstract justice in repairing the damage done by the vehicles themselves, and as a matter of personal interest to the motorist. Through the payment of fees for maintenance of good roads, they assure themselves that they will lower operating expenses, decrease hazards and curtail delays.

Wisdom in Choice of Pavement and Efficiency of Maintenance Necessary

But here is an important point in considering motor-car fees in relation to maintenance. *The cost of maintenance depends upon the efficiency of your highway department.* Put in incompetents or grafters, and the fees will either go beyond bounds or the maintenance will fall short. The general public is not yet educated to knowledge of and insistence upon the best use of the taxes it pays. It is all up to the motor-car users and industries to see that the money for highway purposes be expended by honest men of proved ability. Whether they like to or not, they must concern themselves in politics to the extent of securing good highway men in state service, for the success of their business depends upon the success of the roads, and the success of the roads depends upon highway administration.

For instance, for years Mr. Bennett has been building in Connecticut durable types of pavement with maintenance charges of $100 to $200 per mile per year—a very different proposition from laying water-bound macadam with a maintenance of $1000 a mile or upward a year under heavy traffic. If motor-vehicle fees are to cover maintenance, wisdom must be shown in laying permanent types of pavement for heavy traffic so that repairs will be kept at a minimum.

The maintenance itself must be well advised and executed. Millions of dollars can be squandered on poor materials or on work delayed or done at the wrong time. The proverbial stitch saves nine. The motorist must insist that repairs be promptly made, so that his fee is used to the limit of advantage. In justice to himself, he can't shunt off the responsibility upon some unknown official.

In New York state motor fees are a trifle lower than those in Connecticut. For the past two years they have almost covered the cost of maintenance. Last year fees aggregated $4,284,114; maintenance was $4,939,916. For the nine months of this fiscal year, which ended Nov. 1, fees were $4,571,852.75, while maintenance was over $54,000 less. Maintenance is high now because almost all our earlier roads, built to sustain traffic up to three tons, are protesting against traffic 10 times that wieght. The maintenance includes many complete resurfacing jobs done with durable pavements. As we build better roads, maintenance should decrease, even with increase of traffic. Motor-vehicle fees can then be lowered.

Limitation of Truck Capacity Necessary

Another important point to consider in relation of motor-truck fees to maintenance is limitation of damage that any one vehicle may do to your pavement. It is manifestly unfair to expect all motorists to pay for the destruction done by a few excessively heavy trucks—as unfair as to expect the public to pay $50,000 a mile for new roads to sustain such trucks. There must be an arbitrary limit of load for which we can design our roads. Otherwise, as fast as they are built, roads will attract to themselves traffic heavier than they are designed to bear. The road and the load will be forever outstripping each other, with great economic loss both of the original investment in the road and in the appallingly high maintenance. In addition to regulation of weight of load, there must also be regulation of other destructive factors, such as width and kind of tires, spring, speed, etc. If, after our roads are built in accordance with these regulations, it seems in course of time desirable to put much heavier loads upon them, we may well consider the suggestion made by Mr. Whinery (see *Engineering News-Record* of July 18, p. 142), that we lay narrow-gage tracks on either side of our pavement to carry the heavy trucks.

With these regulations, it is obviously only fair to proportion the fee to the vehicle in accordance with its probable requirements upon maintenance funds. It would not be fair to tax the little two-passenger "flivver" the same amount as the 12-ton truck.

Nelson P. Lewis, chief engineer for the Board of Estimate and Apportionment, New York City, says: "The plan of grading the annual fee in proportion to the gross weight and carrying capacity is rational, and it might well go further and make the total width of the vehicle, where such width exceeds 7 ft., an element in the determination of this fee."

The fees should undoubtedly be graduated in accord-

ance with the destructive factors to the road of the vehicle in question. Such a gradation is now made in many states. I purposely refrain from bombarding your ears with masses of figures.

A graduated scale of motor-vehicle fees to cover the cost of highway maintenance necessitated by the cars themselves would not, I believe, fall too heavily upon anyone. There are, of course, objections to it, but it seems to me the fairest adjustment yet made in taxation between the vehicle and the highway, the motorist and the public.

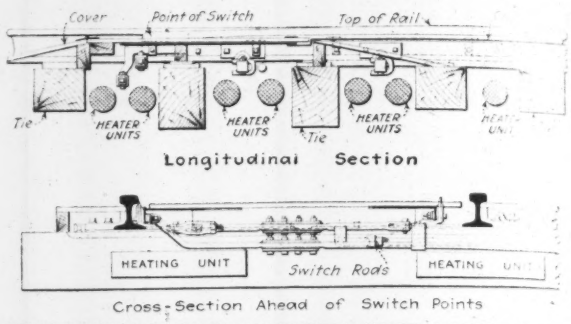
Electric Heaters Keep Track Switches Clear of Snow and Ice

CLOGGING of track switches by snow and ice has been prevented, on the New York Central R.R., by the installation of electric heating devices. On the electrically-operated suburban lines at New York there are 107 turnouts and seven double-slip switches thus equipped, all taking current from the third-rail conductor. There are two heated switches also at Utica and Albany, N. Y., where the line is not electrified. The accompanying view shows one of the heated switches on a third-rail suburban line. The device may be used without the covers, which serve to prevent diffusion of the heat.

The avoidance of delays and interruptions to traffic at busy points is of much more importance than the cost of keeping the track clear. Detentions at junctions and at points of detour and change of power become cumulative when switches operate slowly, as in time of snow and severe cold, so that in the rush hours suburban traffic may be badly deranged unless means are taken to keep the switch operation as nearly normal as possible. This was accomplished last winter by the use of the heaters.

In ordinary storms these devices were found to be completely effective in themselves, no men being required to keep the switches clear. Deep snow aided the efficiency, as more mist and steam arose to prevent freezing on the slide plates and other parts of the switches. On one occasion, when there was not much snow, and a high wind was blowing parallel with the tracks, men were required to help in keeping the switches clear.

Short heater units placed between the ties and directly under the rails, as shown in the drawing, are wired together and connected to any convenient circuit of either direct or alternating current. Each unit is enclosed in a 20-in. length of 3½-in. pipe. When a storm begins the current is turned on, heating the ground and the rails. In laboratory tests the heater was maintained at about 275 deg. F. above atmospheric temperature.

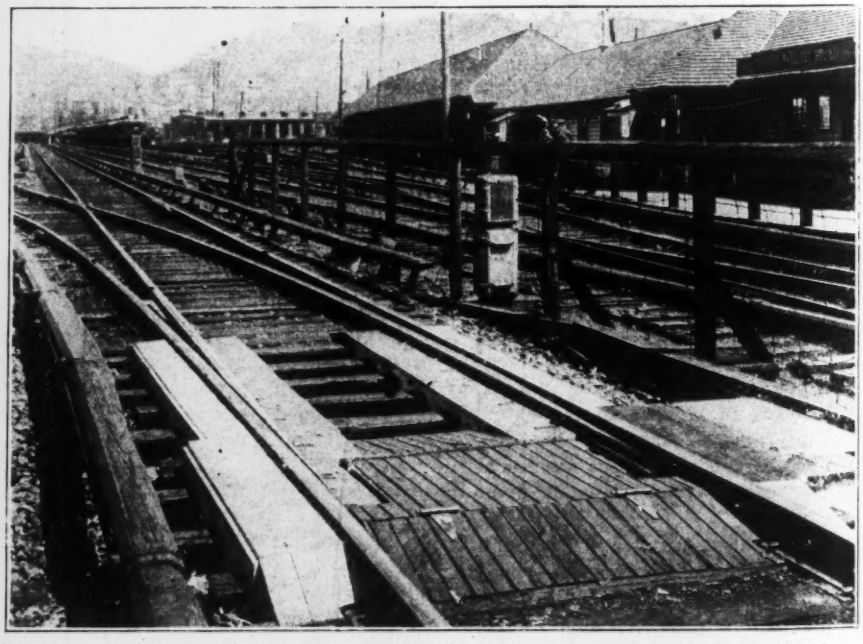


SWITCH HAS ELECTRIC HEATERS WITH COVERING TO RETAIN HEAT

This electric track-heating device is being handled commercially by the Q. & C. Co., New York. It is the invention of Francis Boardman, division engineer of the New York electric division of the New York Central Railroad.

Safety Isles Removed by Traffic Officials

The safety isles in Fifth Ave., at 42nd and 43rd Sts., New York City, have been removed at the suggestion of Special Deputy Police Commissioner John A. Harriss, in charge of traffic, because investigation showed that few pedestrians used them. Instead, they stepped out into the traffic area beyond the lines, and thus left passage room for but one line of vehicles. Besides this interference with traffic, the isles were also found to cause obstructions to large parades. It is said that the system recently introduced at 42nd St. and Fifth Ave., where a line of white marble slabs, extending from curb line to curb line, indicates to the pedestrians the safe area within which he may cross the avenue, will be extended.



HEATER UNITS UNDER THE RAILS PROTECT SWITCH FROM SNOW

German Militarism and Bureaucracy Deplored 27 Years Ago

Remarkable Human Document from Engineer of Berlin Water Filters, Victim of Conditions, Then Growing Worse

ILLUSTRATING "the odious burdens which have been cast off" from individuals as well as nations by the winning of the war, George W. Fuller, consulting engineer, New York City, brought into his recent address as retiring president of the New Jersey Sanitary Association a letter dated Berlin, Jan. 6, 1892, written to him by C. Piefke. The larger part of this letter, and comments by Mr. Fuller, follow:

"Esteemed and dear Mr. Fuller:

"My best thanks for the kind transmission of the 23rd annual report of the State Board of Health of Massachusetts. On a preliminary perusal I have seen with pleasure that you belong to the most industrious co-workers. I shall not fail to study thoroughly the voluminous papers and further to utilize them on appropriate occasions.

"Give also Mr. Allen Hazen my most obliging thanks. Besides, I must beg his pardon on account of my sin of omission, of which in my correspondence I have been guilty. But the last year does not belong to the happiest of my life, and many circumstances have combined to produce in me a certain mental fatigue from which I am suffering partly even today.

"Here in Germany conditions have changed to be very uncomfortable. Militarism and bureaucracy are spreading over our very existence, and despite all effort no success rewards him who does not occupy a high rank within this hierarchy. Then comes the unfortunate passion for titles among Germans in general, so that an individual is not esteemed according to his personal worth, but his social position.

Vain Struggle Against Conditions

"Nothing therefore remains but to pay regard to this national fault, if you do not wish to give up competition. As this is not my intention, I must rise to a deed which I am in fact struggling against, because it appears ridiculous to me, but the necessity of which daily becomes clearer. To you, my dear young friend, I shall delegate this matter.

"First of all, I must endeavor to acquire the title of doctor (in science) so that in this country I may receive the concession for scientific work. As a man of years I do not care to submit to a painful examination, as suits young people. My pride forbids this. But I am gladly ready to write a dissertation and am in possession of suitable material. It relates to a process devised by me for treating ground water containing iron.

"The article could be composed within a few weeks; it is only necessary for me to sit down and write it. What do you think if I should hand it to the Institute [Massachusetts Institute of Technology—Editor] in Boston with a request for a degree? Since you have always shown me how gratefully you remember the small favors that were once shown you here, I am hoping that you will be pleased to take up this matter, so far as your coöperation is practicable. Therefore, you will have the kindness to ascertain what my undertaking would cost, if it is feasible, and what other formalities are to be fulfilled.

"Further, I have yet the wish to secure a more intimate intercourse with the esteemed Institute to which you belong, particularly in a way that I could help pursue the aims held in view. America is today the only civilized country where no restraint is placed upon the pleasure of working, either through antiquated regulations or through the rights of privileged classes. (Signed) C. Piefke."

Mr. Fuller went on to say:

"Piefke, with whom the writer studied in 1890, was then the engineer in charge of the Stralauer filter plant of the Berlin water-works. He was one of the earliest and best investigators of filtration practice, and was an active participant in the strenuous discussions upon the relative hygienic and economic aspects of ground water and filtered surface water-supplies. The medical men and engineers had many wordy conflicts that were not wholly quieted by the performance of the Altona water filters at the time of the cholera epidemic in Hamburg, or by the success attending steps to remove iron and manganese from ground water. The latter years of Piefke's life were spent very unhappily—deprived of his water-works position in Berlin and assigned practically to be a recorder of ground water statistics for the Berlin district.

World Is Now Safer, But Sadder

"If, 27 years ago, humble origin, beyond the confines of Prussia, was so distinct a handicap for a man of very unusual technical ability in various directions, how the oppression must have grown with the rising tide of militarism, bureaucracy and caste! How welcome must be the change and how human are the swings to unwise radicalism which we are witnessing! Today the world is safer but sadder than it was a few short years ago. But accomplishments have been wrought with terrific sacrifices. It remains for those who have not made the supreme sacrifice now to see to it that the appalling losses of life and property will not have been made in vain.

"Fortunately, in America we do not need to worry about holding ajar such newly opened gates to personal ability. Here the doors against opportunity are permanently off the hinges. But, nevertheless, no one will deny that great improvements for the well-being of our population are possible, or that the conduct of this war presents some immediate lessons to that end for every profession."

Large Saving in Army Camp Coal Contract

Substitution of bituminous coal and coke for anthracite at 31 posts, camps, cantonments and stations south of Washington and west of Pittsburgh, with a saving of about $300,000 a year in cost of coal and $200,000 in transportation for the fiscal year 1919, was announced recently by the War Department. About 33,000,000 ton-miles of transportation will thus be made available for other purposes. Some 200,000 tons of anthracite coal was called for originally. Change was made to bituminous coal and coke as a result of investigations by the fuel and forage division of the Quartermaster Corps.

Ship-Design and Quantity-Production Methods of Newark Bay Yard

Project for Factory-Style Shipbuilding Based on Enlisting a New Labor Supply and Using Commercial Steel—Methods Dictated by Delay in Ship Orders—Bridge Shops Fabricate Straight Parts

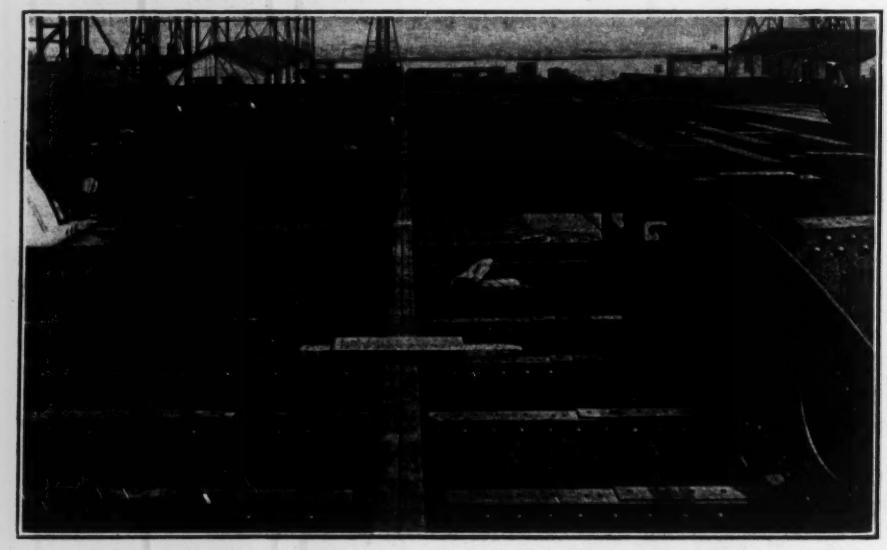
[Passed by Publication Approval Committee, Emergency Fleet Corporation.]

ENTERING upon a project for large-quantity ship production immediately ater the United States went into the war, in April, 1917, the Submarine Boat Corporation brought together shipbuilding and bridge-construction men in a combination which attacked the new problem of high-speed shipbuilding in a radically new spirit. By the early start upon the work, as well as by the effective combination of men directing the enterprise, the development of the corporation's engineering methods and its relations with outside fabricating shops were effectively determined.

Though the Emergency Fleet Corporation of the United States Government did not finally decide to let the large fabricated-ship contracts until well along in September, the Submarine Boat Corporation's planning was carried on throughout the summer in the faith that shipbuilding of the kind in which the corporation intended to engage was vital to the nation's success, and would ultimately be decided upon. Officials of the corporation have stated that they spent no less than $250,000 on developing the enterprise before the Emergency Fleet contract was a certainty. Prosecuting active development on the basis of this faith, they advanced their work so well that they were two months ahead of the other two agency yards—Hog Island and Bristol—in launching their first ship, an event which they celebrated on Memorial Day, 1918.

In 1917 grave fears were entertained that both the supply of ship steel and the amount of experienced shipbuilding labor available would not be adequate to carry out a large steel-ship program. This fact appears to have been one of the underlying elements of the bitter controversy raging throughout June and July between the adherents of wood-ship construction and the steel-ship men in the Emergency Fleet Corporation of the United States Shipping Board. The Submarine Boat Corporation project was based on manufacturing methods by which both difficulties should be circumvented. Commercial structural-steel shapes, of which the supply was relatively ample, were to be used instead of regular ship shapes, and plate steel of bridge or structural grade was to be used instead of the very scarce ship grade, made to specifications involving numerous added complications in furnace and steel mill. Furthermore, the problem of putting a ship together was to be attacked as a steel-erection problem, using bridge builders instead of shipyard men. Thus, a new supply of material and a new supply of labor would be enlisted in the work, according to the plans of the corporation. As is now widely known, precisely these expedients are what have created the vast steel-ship building industry developed in the United States within the past year.

After the Submarine Corporation's project was laid before the Emergency Fleet Corporation, and the head of the latter, General Goethals, had taken a keen interest in the proposals, the matter of design was taken up with Theodore E. Ferris, naval architect to the Fleet Corporation. The outline design previously prepared by the Washington authorities, for a 3500-ton wooden ship, was the starting point. As the development of a steel design for a vessel of similar size proceeded, and the practicability of shop fabrication and yard assembly impressed itself more strongly on all concerned, the size was increased. It went to 4000 tons, then to 4500, and finally to about 5000. Preparation of detailed drawings and molds or templetes during the summer, before the contract was received, was probably the element which saved the largest amount of time, though it also involved a large expenditure. In carrying out this preliminary work, which was done in a large shop at Bayonne, N. J., obtained for the purpose, the templets or molds were marked directly from full-size lines of the ship laid down in the mold loft, without waiting for the preparation of detail drawings, as the working drawings would have reduced by only very little the time needed for



PRE-ASSEMBLY OF FLOORS IN PAIRS OR GROUPS OF THREE FACILITATES HANDLING AND ERECTION

making molds. Since the company's project involved making the parts of the ship at various bridge and structural shops throughout the country, molds had to be furnished to many shops, and it was vitally necessary that the fit of parts should be assured before shop work was commenced. The natural result of these conditions was the decision to start on the mold-loft work as early as possible, and complete the molds for the use of the bridge shop with the least possible delay. Work was far advanced when the emergency shipyard contracts were finally let.

That assembly of ship parts manufactured at a distance was practicable had been learned in a very practical way by the corporation a year before, in building 550 patrol boats of 32-ton size for the British Admiralty. These small vessels were "manufactured" in the company's Bayonne shop, but were not assembled there. The parts were shipped to Canada and were assembled into finished boats at yards in Montreal and Levis. Though the hulls were wooden, the various methods and problems of shipbuilding, and the question of whether ships could be built by an interchangeable manufacturing system, were quite fully put to the test in executing the contract. From the satisfactory results obtained in the assembling yards, the corporation's officials became convinced that the system of separating assembly from shop manufacture could be applied to shipbuilding just as well as to machine manufacture. With such subdivision it seemed that effort could be concentrated on ship construction to any desired degree, and thus ship production speeded up almost without limit.

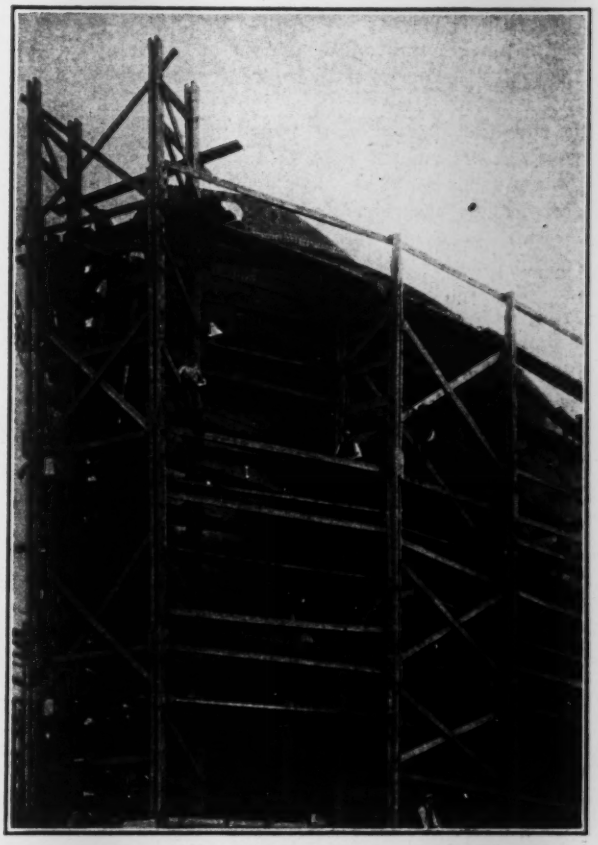
It is a noteworthy fact that shop fabrication at inland points and assembly in the shipyard had been going on during nearly two years preceding this time, carrying out some of the purposes which the Submarine Corporation people had in view—in the shipbuilding enterprise of Capt. C. P. M. Jack, for which straight ship parts were sheared, punched, and riveted by the American Bridge Co. at its Ambridge barge-building shop, and assembled at Chester, Penn. The Submarine company was not in touch with this work, however, and developed its project quite independently.

In its detail development, the corporation's project was influenced by the conviction that best results would be obtained by depending on many small shops scattered throughout the country, rather than on a few large shops. The ultimate outcome of this idea is reflected in the fact that structural-steel fabricating shops scattered from the Atlantic coast as far west as Iowa are making hull parts for Submarine Boat Corporation ships.

Data concerning the available capacity of bridge shops for ship work were collected during the summer of 1917. The very large shops, perhaps a dozen in number —those of the American Bridge Co., the McClintic-Marshall Co. and the Bethlehem Steel Bridge Co.— were not included in the program, but outside of these the best equipped plants were enlisted in the work.

Similarly, early steps were taken to find the most suitable site for the plant. The Newark Bay location, using ground already reclaimed from marsh by the City of Newark, N. J., for a shipping terminal, was chosen and arranged for in June. The immense labor market of the metropolitan district of New York, with few shipbuilding industries competing for labor, furnished a prime reason for considering this the best site for a yard. With a site chosen, bridge shops under contract, and the molds and templets largely completed, by the time the emergency ship contract was awarded the Submarine Boat Corporation was able to make rapid progress.

The Lackawanna Bridge Co. and the Worden-Allen Co. became affiliated with the corporation at an early



CURVED AND IRREGULAR PLATES AT BOW FABRICATED IN YARD SHOP

stage of the work. This brought to bear on the work the structural-steel experience and resources of two large fabricating and erection companies, and enlisted the assistance of minds not previously applied to shipbuilding—carrying out the fundamental idea of the corporation that large-quantity production of ships at high speed was a problem of such new character as to require new men and new minds for finding the best solution.

In designing the ship it was realized that the parallel body of the vessel offered the largest opportunity for shop fabrication. At the same time, the analogy of tank work made it clear that the curved plates of the molded ends of the ship could also be sheared and punched in the shops, and could be curved either there or at the shipyard. In view of the difficulties in shipping curved plates, it was decided to do all the curving at the yard. For the same reason, bending the frames

of the molded ends was allotted to the yard, and this meant that the punching also had to be done at the yard, as it is impracticable to punch the channel or angle frames before heating and bending.

Plates Rolled at Yard Shop

Of all the plating of the molded ends of the ship, less than two dozen individual plates are of distinct double curvature or "formed" so deeply as to require hot forging. All others, and the bilge plates of the parallel section, can be shaped by rolling to cylindrical curvature (generally on an axis inclined to the length of the plate); this rolling is done at the shipyard shop, the plates coming to the yard fully punched, but flat.

The result is that 95% of the shopwork on the Submarine Corporation ship, including very much of the work on the molded ends, is done in the bridge shops, distant from the yard. Two small bending shops at the shipyard do the remaining 5%, all of it curved work. In this reckoning the forged plates, the stern-frame castings and a few similar items have been counted in with the bridge-shop portion, although they come from other outside shops. The steel castings, for example, are made in a Buffalo foundry, and the furnace plates are die-forged in a Chicago shop and one in Joliet.

The hull outline was furnished by the Emergency Fleet Corporation, having been drawn by its naval architect, Theodore E. Ferris. Efficiency of production required as great a length of parallel middle body as possible, while efficiency of propulsion called for a minimum length of middle body.

In the general shaping of the ship the same course was followed that has characterized all the rapid ship-production designs put into the yards during the past year. Many conventional ship curves were discarded in order to simplify the shopwork. The rounded shape of the midship section, the longitudinal up-curving of the ends, and the transverse down-curving of the decks to the side, are elements which, though having some navigation value, are now considered to be largely based on pure tradition in shipbuilding, handed down from the early wood-ship days. Great simplification in fabricating the frames and shell plating can be obtained by straightening out many of these curves. In the present instance, the midship section was made as nearly box-shaped as possible, and the longitudinal deck profile (shear) was made up of straight-line segments instead of being curved. The decks were designed without the usual transverse camber.

By making the bottom plating horizontal and the tank-top parallel to it, the transverse girders of the double bottom, the "floors," were converted from tapered girders to girders of constant web depth, much simpler to build in the shop. The sides of the ship being carried up plumb, the frames became straight, and this, in conjunction with horizontal decks, gave uniform right-angle connections at the deck beams. The deck beams were made straight instead of curved as is usual—by discarding camber. Avoiding curved sheer profile gave the advantage of having a constant flange bevel in the deck beams of each section.

The Submarine Corporation's ship has the ordinary transverse framing, with spacing of 27 in. between centers of frames. Following usual ship practice, floors with plate webs ("solid floors") alternate with open floors, consisting only of upper and lower flange angles and occasional angle stiffeners; in the parallel body two open floors occur between solid floors. This grouping was utilized in carrying out an important expedient for speeding up the erection—namely, assembling groups of floors in the fabricating shop, as noted farther on.

The frames, or vertical members supporting the shell plating of the sides, are channels in the middle three-fifths of the ship's length, and bulb angles in the end positions. The attachment of these frames to the double bottom by brackets involves no curved work, in virtue of the flat tank-top margin, as compared with the usual construction in which the tank-top is bent down normal to the bilge at the margin.

Rolled shapes of "ship" section were avoided in favor of standard structural shapes, because the latter could be obtained most readily and are in stock in the yards of the fabricating shops. Only one unusual section is used, a 7 x 3½ x ⅜-in. bulb angle in the frames of the bow portion. The middle-body frames are made of 12-in. structural channels instead of 13-in. ship channels, against the argument of naval architects in favor of the deeper and wider-flanged ship channel.

Simplification Discussed with Classification Societies

Shell-plate thickness and rivet diameter in ordinary shipbuilding are governed by the strict rules of ship-classification societies in such a way as to call for a considerable range of variation in sizes. Simplification was accomplished here, in the interests of fabricating economy. Extensive discussion of such changes with ship-classification societies was necessary, because the Emergency Fleet Corporation required that ship designs should be approved by both Lloyds and the American Bureau of Shipping, and that the inspection during erection on the ways should also be supervised by these organizations. Some delay in the development of the designs resulted from having this jurisdiction superadded to that of the Emergency Fleet Corporation's own organization.

When the attempt was made to lay out the plate work for the use of multiple or gang punches, the rigid rivet-spacing rules prescribed by ship-classification rules were found to make this impossible. No concessions as to variation of spacing could be obtained from Lloyds' inspectors, and the only way that the multiple punch could have been suited was by a considerable increase in the number of rivets. Such increase was highly undesirable, as it meant more field riveting; and, since only one or two of the shops were equipped with multiple punches, all riveting was laid out with no regard to multiple-punch requirements.

Joggling of frames and floors to follow the in-and-out shell plating, common shipyard practice, was avoided by using fillers or "liners," as bridge shops are not equipped for it. Similarly, scarfing the corners of plates at the junction of butts and seams was avoided, although called for by the rules; the inspectors permitted the use of beveled liners at these points, as sketched (Fig. 1).

Similar special operations are required in customary ship practice in the splices of the keelson girder web, which ordinarily are lap splices, requiring scarfing where the lapped web goes between the flange angles. In place of this construction a butt splice was used just the same as an ordinary plate-girder web splice, with the exception that, as the joints must be calked water- and oil-tight, a tight fit of the splice bars against the edges of the flange angles must be secured. The construction shown in the sketch, Fig. 2, was adopted; the splice plate on one side is fitted tight against the leg of the flange angle, which latter is chipped square for the purpose, and the joint is subsequently butt-calked.

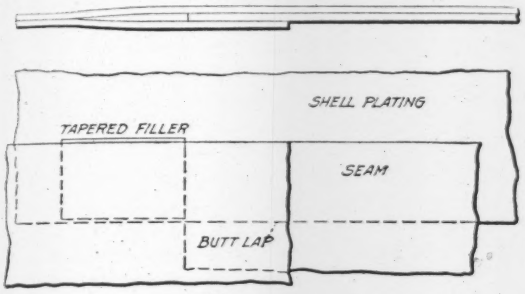


FIG. 1

In one of the fabricating shops this construction was departed from by making an ordinary butting contact of the splice plate (without chipping the angle) and welding the plate to the angle by gas flame.

To facilitate die forging of double-curved plates, the designers endeavored to concentrate the sharp curvature at any one point in a single plate, if possible. At the plate covering the propellor boss, for example, two or more plates, each of which can be forged without dies, are frequently used. In the present design, a single

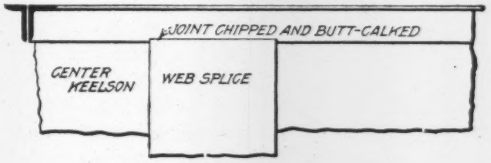


FIG. 2

plate is substituted, and in view of the quantity production this plate can be cheaply forged in dies. The ship has only 18 furnace plates: three steel plates at the stern and three at the bow, two plates at each quarter of the bilge, two propellor boss plates, and two stern plates under the transom.

Erection economy led to grouping the floors for shop assembly in sections of two and three floors, with the intercostals or longitudinal members connecting them. A large increase in shop riveting and decrease in field riveting were accomplished by this shop assembly, and the yard officials state that there is a large gain in erection speed by reducing the number of pieces to be handled.

The drawing and templet system which the corporation uses was controlled by the time available last summer for designing and mold-loft work. The structural men in the company having decided that the most satisfactory fit of parts would be secured if only straight work were assigned to outside shops, the yard was equipped to do all bending of frames and rolling of plates. The molds and templets for all the curved parts were worked out in the mold loft, formerly located at Bayonne but now directly alongside the yard shops. These molds never leave the yard and are subject to easy check either from the mold-loft lines or from actual fit on the ship. The construction of the first two ships was in fact made the opportunity for testing all the molds and, where necessary, correcting them to secure perfect fit.

The straight work of the ship was in general left to the ordinary methods of the particular bridge shop to which it was allotted. It was expected that templets would be made by each shop in accordance with its normal procedure. For check purposes, however, cardboard templets of plates, and wooden stick templets of flange angles, stiffeners, etc., were made in the mold loft and were sent to the shop. These were subject to verification by over-all measurement at the shop, before being used for checking or for laying out a working templet, thereby eliminating risk of error from shrinkage. The cardboard templet system was also used for the curved plates, for punching, and in these plates the great susceptibility of cardboard to change length with moisture variation made it necessary to apply the over-all dimension check very scrupulously.

The original plan was to retain no drawing record of the molded plate work except the general shell expansion and the order sheets showing the over-all plate dimensions as determined from the mold-loft measurements. A tabulation of offsets of all mold-loft curves was made for file purposes. Later it was decided that permanent, accurate drawings of the curved work would be useful in many ways during construction, besides affording invaluable insurance against delay in case of destruction f molds or of the mold loft. Such drawings were therefore made, from measurements taken directly off the molds. The curves of all the plates, both in developed representation and in rolling profile, were shown by offsets at each of the several frames involved, permitting accurate reproduction. Usually, four or five plates could be grouped together on one sheet, and two or more frames.

In the speedy erection of the first vessel—launched, as already mentioned, on May 30—and in the smooth progress of operations at the shipyard, resulting in the launching of 15 ships by the end of October, the full success of the shop-manufacture-and-yard-assembly idea has been demonstrated. With steady driving of erection work on the ways, high-speed shipbuilding has been made dependent only on getting the work through the bridge shop and obtaining its delivery at the yard promptly and in the order most suitable for erection. The 28 ways of the Submarine Boat Corporation's yard have all been in service since early spring. At present two ships are being launched each week—both on the same day, to minimize the disorganizing effect of launching days. By spring a schedule of three ships per week should be attained.

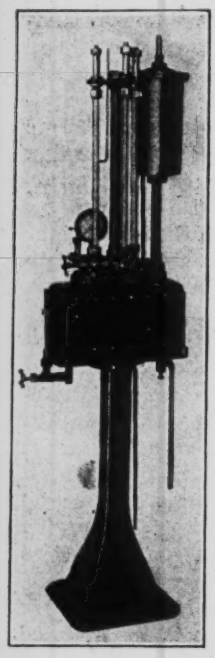
Chicago Introduces New Chlorinator

By John Ericson,
City Engineer, Chicago

(Abstract of paper read before American Public Health Association, Chicago, Dec. 9-12).

WATER treatment with liquid chlorine is practical at all of the pumping stations of the Chicago water-works. Maintenance of the delicate apparatus in proper service conditions has been somewhat difficult, and absence of trained operators, due to war service and vacations, has made the situation worse. Having its own shops and foundry, the city has been able to keep the apparatus in continuous operation, which would have been practically impossible if it had had to depend entirely upon the manufacturer for repair service.

Apparatus at the older pumping stations is capable of considerable improvement, particularly in eliminating delicate parts, joints and valves, and in giving a more dependable distribution of the desired amount of chlorine. A step in this direction has been taken in the equipment of the new Mayfair station, which was opened in August, 1918. This station has five triple-expansion plunger engines with a combined daily capacity of 110,000,000 gal., and will have an ultimate capacity of 152 000,000 gal. Water from the supply tunnel rises through a main shaft at the station, and here the chlorine solution is applied by pipes extending 55 ft. below the upper tunnels which lead to the pumps.



"AËRISOSTAT" MEASURES OUT LIQUID CHLORINE UNDER CONSTANT HEAD THROUGH VOLUMETERS

Two independent sets of apparatus are installed to provide against breakdown. Each unit consists of a battery of nine chlorine cylinders connected to a manifold receiver for equalizing the pressures. From this receiver the gas passes into an "aërisostat," which regulates the quantity of chlorine required, and wherein the pressure is reduced just sufficiently to drive the chlorine gas through wrought-iron piping to a room over the main or rising shaft. In this room are two sets of two mixing towers providing for the reception of four ¾-in. chlorine pipes. These towers are made of hard rubber; they are 7 ft. high and 8 in. in diameter and are filled with pumice stone. A chlorine pipe enters the top of each tower and extends to within 6 in. of the bottom. It is covered with a copper spraying cone into which falls a stream of filtered water that works down through the pumice stone. The chlorine gas rising in this same inclosure is absorbed by the water, thus forming the real chlorinating solution.

From the bottom of the mixing tower extends a 1-in. hard-rubber pipe connected to a 1¼-in. rubber hose through which the chlorine solution is discharged into the raw water at about 90 ft. below lake level or datum. This hose is protected by a 2-in. galvanized-iron pipe anchored to the wall of the shaft.

The "aërisostat," which is the regulating and pressure reducing part of the apparatus, consists essentially of low-pressure float-controlled chambers, based on the principle of the U-tube, with legs of different areas proportioned to equalize the effect of the higher pressure of the chlorine cylinders and the low pressure required for the delivery of the gas to the absorption tower or other point of delivery. It was developed and adopted from sensitive flour-bleaching apparatus by the Municipal Supply Co., Chicago. The main chamber is divided into two parts of proportionate areas by a partition extending to within a certain distance of the bottom. This chamber is nearly filled with pure sulphuric acid. Chlorine gas from the cylinders is admitted to the top of the chamber through a circular opening, the underside of which forms a seat for a vertical needle valve.

As soon as gas is admitted through this valve into the larger part of the chamber the gas pressure upon the sulphuric acid forces the liquid up into the smaller one. A float in this latter controls the opening and closing of the needle valve as the pressure of the gas causes the fluid to rise or fall. In the older apparatus this regulation is obtained by reducing valves of the diaphragm type, with counteracting springs. Close watching and attention are found necessary to keep these in operating condition.

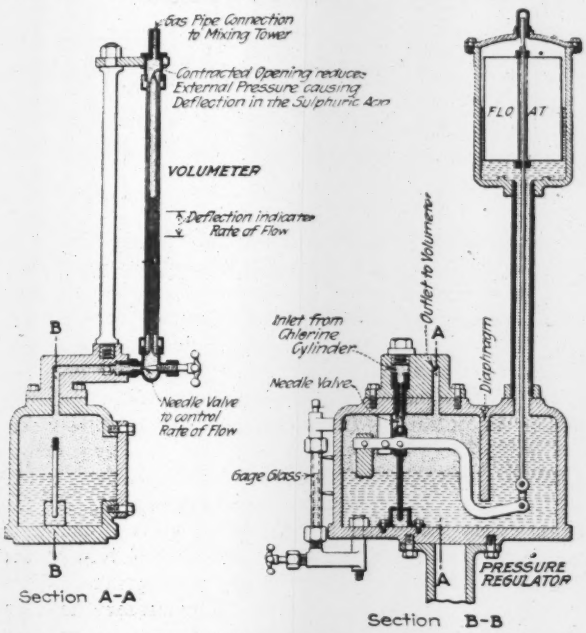
Partitions of steel and glass isolate the installation from the pump room. An electrically operated exhaust fan ventilates the inclosure, and a red pilot light indicates when the fan is operating. Heating equipment will keep the temperature within the inclosure at 90° to 95° F. and in the main gate shaft the temperature should not go below freezing. The temperature is controlled by thermostats.

Two dial-reading chlorine-weight indicators are installed as a check on the distributing apparatus. The weighing platforms are inside the inclosure but the indicators are outside and have pointers so arranged as to show the number of pounds of chlorine used. Recording gages showing the pumpage of the water and the dosing by chlorine give an accurate account of the proportion of chlorine used to the water pumped. It would be far more desirable, however, to have a satisfactory means of regulating automatically the amount of gas used in a definite proportion to the pumpage. This seems feasible with a venturi meter when used to record the flow of water, as it may be connected to the apparatus controlling the flow of chlorine, automatically increasing and decreasing the flow of gas as the pumpage increases and decreases. This problem will receive attention.

Although the most modern apparatus and all improvements which past installations have suggested are used at the Mayfair station, it appears that considerably more experimental work will have to be done, and a special study of the chlorine plant at this station will be made with a view to future improvements.

Chlorination for the sterilization of water for domestic purposes is evidently a correct principle, judging by the results obtained in Chicago since complete chlorination has been in vogue. Bacteriological tests

made on untreated water in 1916 showed 18 colon bacilli present in 1 c.c. per 1000 samples, while samples of water treated with chlorine showed only 0.9 per cubic centimeter. There is, therefore, a strong indication



SULPHURIC ACID IN BALANCED VALVE ARRANGEMENT KEEPS LIQUID CHLORINE DRY

that the use of chlorine reduced the death rate due to typhoid fever more than 70 per cent.

Bacteriological tests made on untreated water during 1916 showed colon present in 1 c.c. in 18 samples out of 1000 examined, whereas the corresponding number of contaminated samples in treated water during the first nine months of 1917 was $\frac{9}{10}$, or less than one per 1000 samples examined. During the first nine months following complete chlorination of the water-supply the death rate from typhoid fever was reduced by 71.44%. There is, therefore, a strong indication that the use of chlorine reduced the death rate due to typhoid fever more than 70 per cent.

Chicago Faces Sewage Disposal Problem

BY C. D. HILL
Engineer of the Board of Local Improvements, Chicago

(Abstract of paper read before American Public Health Association, Chicago, Dec. 9-12).

AT PRESENT the matter of sewage disposal at Chicago is in a critical stage. The Federal Government may restrict the flow from Lake Michigan so that it will be impossible to dilute the sewage to the extent required by the act of 1889. Under this condition the state Government would be justified in objecting to the discharge of the grossly polluted water from the canal into the Des Plaines River, and in requiring the construction of works for treatment of the sewage. To build treatment works that would so purify the sewage that with the limited dilution of lake water the effluent would not constitute a nuisance would require years, and would cost so much that legislation would be necessary.

There is in Chicago a lack of appreciation of the seriousness of this situation. Few realize the opposition of Federal officials to the operation of the drainage channel in accordance with the original plan, and still fewer realize the opposition by other cities along the Great Lakes. This opposition is due largely to a mistaken notion as to the effect of the flow of water through the channel upon the level of the lakes.

Even if we should obtain from the Federal Government permission to operate the channel at its full capacity, it would be necessary to install auxiliary purification works, and once more we would repeat history by showing the inadequacy of present methods long before new works could be installed.

No serious mistake has been made in the successive steps through which the sewage-disposal works of Chicago have evolved, except the mistake of procrastination. Each step has been logical and reasonable, and other methods would probably have been unwise. When the present works were planned a few progressive engineers favored sewage treatment. If such a plan had been followed, probably the method adopted would have been obsolete before the work of treatment had been fairly started.

The best means of sewage treatment may not have been developed as yet, but the time is approaching when some method supplementing dilution of the sewage must be adopted.

Ohio Engineers Have Fixed Charges for Professional Services

Per diem rates of pay for engineering service of various kinds have been standardized to a certain extent in the Mahoning Valley, Ohio, through the efforts of one or two men who have been sending out rate cards to the engineers of the valley. Some of the rates are as follows: For consultation, opinion, testimony, preliminary investigation, reports, and consulting capacity upon design, minimum, $25 per day. (While absent from the city, attending court, or performing similar duties, or traveling, each day of 24 hours, or a fraction thereof shall be considered as one day, irrespective of the actual time spent on the case. Otherwise seven hours shall constitute one day.) For examination or reports of an extensive nature covering several days, minimum, $15 per day; engineer in charge of field work, minimum, $10 per day; assistants, classed as instrumentmen of party, minimum, $5 per day; assistants, classed as rodmen, chainmen, etc., minimum $3.50 per day; inspector on paving, sewer, etc., minimum $3.50 per day; minimum charge for field work, $10. To all the above an additional charge will be made to cover actual expense, including stakes. Residence lot, minimum charge $10; calculating, draughting, etc., $10 per day, minimum charge, $2.50 per day; minimum charge for any one map, $5. For percentage work on sewers or disposal plant under $3000, per diem rate; for contracts under $30,000, 8% for first $15,000 and 7½% for second $15,000. For paving, the charge is to be 1% less than for sewers.

The client is to pay for one inspector on percentage work. The above rates are a base for contracts with a reasonable time limit in the contract, and all overtime is to be based on the per diem rate.

Principles Controlling the Layout, Marking and Maintenance of Trunk Highway Systems

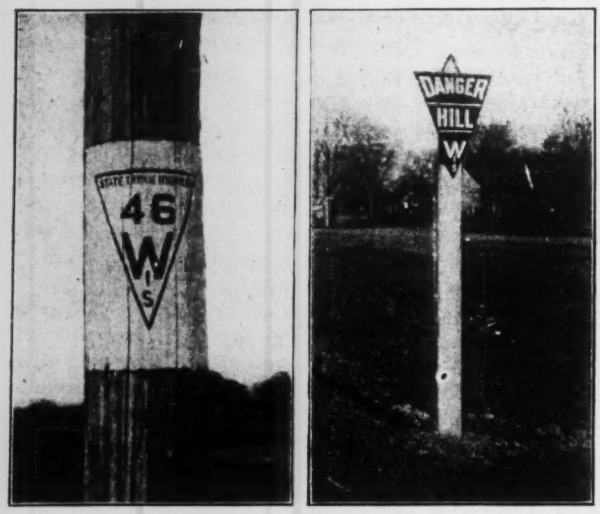
Detailed Account of Methods Followed by Wisconsin Recently in Inaugurating a 5000-Mile System of State-Maintained Highways—Patrol System, Paid For by State, Is Administered by Counties

By A. R. Hirst
State Highway Engineer of Wisconsin
(Paper read before the Joint Highway Congress, Chicago, Dec. 12, 1918.)

(Concluded from last week)

A STATE trunk highway system which is not completely constructed—or even if it is completely constructed—is of no great value to the traveling public unless it is so marked on the ground that the traveler may follow it without trouble. The marking and signing of a state system is a problem in itself, and to this problem we have devoted a great deal of attention.

Our state trunk highway law provided that each state trunk highway should receive a number, which should be displayed along the road itself in a standard design, similar on all state trunk highways except the number. These highways are numbered in order of their length in miles, from 10 upward, the longest (456 miles) being number 10. The idea in selecting



WISCONSIN STANDARD STATE TRUNK HIGHWAY MARKER AND METAL DANGER SIGNS

Danger signs are uniform for hills, curves and railroad grade crossings, except in central wording

10 as the lowest number was that every highway number should contain two digits, and thus give uniformity.

After considering a large number of designs for the standard marker it was decided to use a triangle containing at the top the words "State Trunk Highway," then the number in large figures, and in the lower point of the triangle the word "Wis." The triangle is 10 in. wide at the top and 13 in. long and is placed on telephone poles on a white-lead and oil-paint background 18 in. wide; the triangle and the lettering being coach black. We find that it is advisable to be rather profuse with these road markers. There should be one or two on each side of intersections with other roads, and an occasional one between intersecting roads. The traveler welcomes their kindly reminder that he is still on the right road, especially at night, even when they are not absolutely essential for guidance. The white bands are just as valuable as the marker itself in outlining the route. Where a turn should be made the white band is widened to 30 in. and an "R" or an "L" stenciled beneath the marker in the white field. These markers were placed upon the telephone and telegraph poles, fences, culvert end walls, and in some cases on boards nailed to trees, where other objects were not available.

By the coöperation of the 71 counties, the whole system was marked in one week. Each county did the marking within its limits, the stencils and instructions being furnished by the State Highway Commission. As a matter of interest, 1 gal. of good, thick white-lead and oil paint covered about 60 average poles, two coats, the bands being 18 in. wide. The cost of marking in the counties varied with the care taken, the complexity of the roads, the length in the cities, etc.; the highest county rate per mile was $5.25; the lowest $1.00. The total cost of marking the 5300 miles was about $9000, or at the rate of $1.70 per mile.

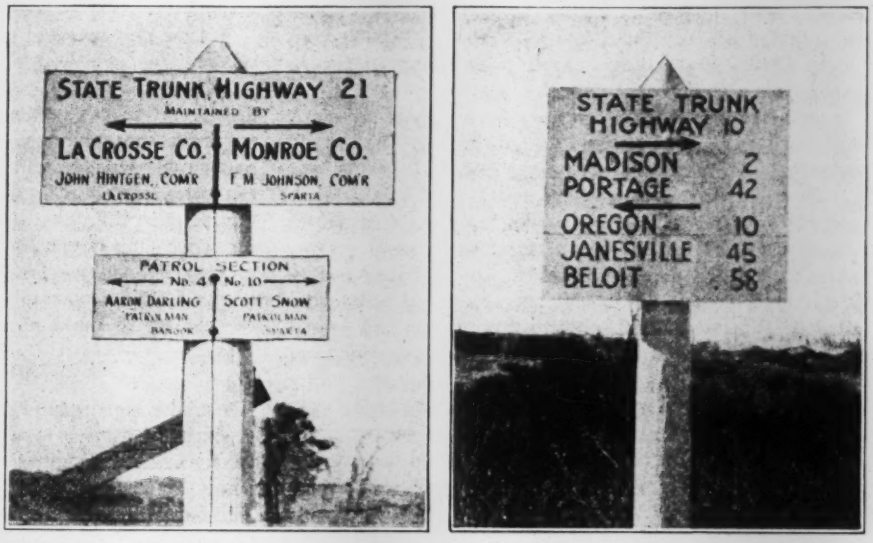
The marking covers 5300 miles, although only 5000 miles are on the system and mantained. This is due to duplicate marking where two trunk highways follow the same road for a distance, and to the fact that the marking continues through all cities, although streets, in fully built-up districts, of places larger than 2500 population are not a part of the system and are not state-maintained. Careful and full marking through cities and villages is very essential and can hardly be overdone.

The system of numbering the highways has proved to be very satisfactory. The principal highways are now called by their numbers just as naturally as people call trains by number. For instance, if one asks in Madison the road to Wausau, he will be told, "Take State Trunk Highway No. 10," or if one is in Milwaukee and wishes to go to Fond du Lac, they will tell him just as naturally to "Take No. 15," and so on.

Other Signs and Markers—We have erected county-line signs and state-line signs giving the name of the two counties and the county highway commissioner's name and address. On the same principle, every patrol section has a sign at each end, giving the name of the patrolman each way from that point. These two types of signs are placed so that the traveler may

know who is responsible for the maintenance of the section of road over which he has just passed and of the section into which he is passing. We have found these signs very valuable in stimulating the natural spirit of competition and pride which should exist in patrol work.

We have also set up standard mile-posts or markers showing the state trunk highway standard design and number and the mile number measured from the east or south end of that especial state trunk highway. These mile-posts serve to tie our office records to the road itself, and also enable any traveler encountering good or bad conditions to boost or to complain to us as the case may demand, and enable us to locate the exact place mentioned. Culverts and bridges are numbered and tied into the mile numbers; thus, the first culvert in mile number 25 on trunk highway 10 is 10-25-1, and the first bridge is 10-25-11, etc. All mile-posts are of wood and cost us about $1.50 each, erected. We are erecting about 2000 direction signs. These are board signs painted white, with black lettering. They are divided into "on system signs"—that is, signs at intersections directing both ways to places on that state trunk highway or beyond, and giving the mileage—and "off system signs," located at intersections with other roads and directing to important points not on the state trunk highway system. These "off system signs" are located only at the intersection with the one road which should be taken from the state trunk highway to the point in question. A lecture could be given on the danger of indiscriminate signing, where several consecutive intersections give directions to a certain point when only one road should be used to get to that point. In brief, we believe that indiscriminately located direction signs do more harm than good.



WISCONSIN STANDARD COUNTY LINE AND PATROL SECTION SIGNS, AND "ON SYSTEM" TWO-WAY DIRECTION SIGNS

We have also designed and have had made special metal danger signs for railroad grade crossings and dangerous hills and curves. These are the only metal signs we have used, and cost us $1.365 each, f.o.b. Madison. Caution signs stenciled on telephone poles or other convenient objects are used where there is no real danger if reasonable care is exercised.

Direction signs and all other signs are erected on wooden or concrete posts painted white. All posts and the mile markers should be erected as close to the traveled way as is possible without interfering with maintenance operations or being dangerous to travel. This is necessary in order to bring them within the area of motor-vehicle lights at night, when the markers on telephone poles are sometimes hard to catch.

Protection Marking—In addition to the above, all of which serve to outline the course of the system in one way or the other, we expect next year to paint or whitewash the end walls of all culverts, the end posts of all bridges, to place posts painted white at the end of all culverts without end walls, and where the fills are not high and we have no guard rails we shall outline the edge of the fills with stones painted white or with occasional white posts. This epidemic of white along the state trunk highways will be an additional distinctive marking and help travelers to follow the system, especially at night, besides serving the first essential purpose of indicating points of danger on the edge of the road. Some of our counties have this year done much of this kind of work, and it has been found very effective for night travel.

Including the marking of the triangles (costing $9000) the total cost of marking, signing and protecting the state trunk highway system will be $25,000, or at the rate of $5 per mile. We believe that this expense, and much more, can be fully justified by the results attained. Our people are well satisfied with the system of marking and signing used, and we have received many compliments from travelers from other states who have passed through Wisconsin.

Maps

The next thing after the system is laid out, surveyed, recorded and marked is the publication of a map, which will enable the traveling public to select their routes and the numbers properly. We are publishing a wall map (scale 1 in. = six miles) showing all roads in the state, with the state trunk highway system, and the secondary roads outlined in red. This is small enough for general office use, and while the sale of such a map is limited, it is valuable for display in hotels, garages, clubs, etc.

A map for general public use in touring is published on a scale of 1 in. = 16 miles. In addition to showing the numbered and marked state trunk highway system and the principal secondary roads, the points of historic and scenic interest and state institutions are also lo-

cated and numbered. Accompanying this map is a little booklet on Wisconsin giving her history, an index to historic, scenic, manufacturing and state property features located on the map, some record of the state's agricultural and manufacturing resources, and other material of interest. These maps are sold for 10c. each. After the first edition, the cost of which included about $350 for the plates and set-up, succeeding editions cost, addressed ready for mailing, about 7c. each, including 1c. for postage. About 20,000 were sold in 1918. We expect a larger circulation in future years.

It has been suggested that we issue sectional maps on a larger scale, but we do not believe that it is advisable. It takes a very large scale to enable one to follow a road map on the ground. With a good marking system a small map which enables one to select a route and get its number is as good as any.

The sale of the ordinary touring books giving routes by descriptive reading matter has been seriously curtailed in Wisconsin by the state numbering and marking system. These books still have their field of interstate travel, but we believe should coincide more carefully with state routings, where established, than some of them do at present. Many of the routes given in these books must have been established before the present dry era came in. Some of the route-book publishers are correcting their publications to date and are following our state trunk highways wherever offered.

Construction

All Federal-aid construction is concentrated on the state trunk highway system. The legislature has also provided that at least one-half of the state-aid money, together with the county funds, should be expended on the state trunk highway system. So far as possible these funds will be used to construct those places at present impossible to maintain in their present condition. We have no hope of reconstructing the entire system in an adequate manner for several years, but are using the limited funds available to get rid of the road terrors and thus strengthen the weak links in the transportation chain.

In our state-aid construction for the next year or two we are going to relax from our previous standards and convert construction funds into heavy maintenance work covering much more mileage. This will be true in both grading and surfacing work. Results secured by our gang maintenance this year fully justify this extreme departure from our previous practice, if good patrol maintenance is immediately established.

We are insisting that no detours be made around construction except where traffic absolutely cannot be maintained. We do not believe that state or county organizations have been considerate enough of travel. Detours almost inevitably lengthen and confuse the route and almost inevitably are worse for the traffic than if it were allowed to go through. We insist that no more road be torn up at a time than is absolutely necessary, and that the contractor keep his grading smoothed up and help travel through wherever travel can possibly be admitted. Wherever a detour has to be established we are thoroughly marking its points of departure from the trunk highway, outlining by paper detour signs, similar to the state trunk highway marking, its course around the construction, and placing the patrolman on the detour to do as much as he can for the detour route during the period of construction.

PAPER SIGN USED ON ROAD CONSTRUCTION

We are having great trouble in getting contractors and foremen to be considerate enough of travel. They seem to think that the traveler is a common enemy, instead of realizing that he is largely paying the bill, and that inconveniencing him unduly and arbitrarily may make an enemy to the good-roads movement, when we should all be seeking to make every man its friend.

Maintaining the System

We are now coming to the most important work in connection with a state trunk highway system. We do not believe that a state should lay out a state trunk highway system unless from the instant it is laid out it is maintained by the state at the expense of the state. The maintenance should be either under the direct control of the state department or, if under county control, subject to direct state supervision.

The fault with practically all so-called "trails" in America has been that they have been established with a great deal of gusto, barrels of paint were used in marking them, and then those interested have stepped aside and let the traveler encounter what he might, without any attention being paid to securing systematic maintenance of the roads which he is invited to use. The ordinary trail promoter has seemingly considered that plenty of wind and a few barrels of paint are all that is required to build and maintain a 2000-mile trail. Inevitably, with the establishment and marking of trails, more travel is directed to them. If this increased travel is not immediately accompanied by adequate maintenance, the trail, instead of being the best road through that neighborhood—which it may have been at the time of its establishment—will very shortly become the worst, and one to be avoided.

In the same way, if a state lays out a state trunk highway system, it must at the same time provide for its adequate maintenance. The counties will not maintain it, the towns will not maintain it, neither will the cities nor the villages, because all of them reason that some day the Federal Government or the state, or both, is going to build it—or at least help to build it on very favorable terms—and why should they spend any money on it for either construction or maintenance? We hold it a truism that the establishment of a preferred system of roads by any unit of government should carry with it the immediate maintenance of that system by the establishing unit. It cannot be over-emphasized that a state system of roads should not be laid out unless real state control of its main-

tenance is also provided. The state should pay for the maintenance, for state control without state money is bound to be difficult, not to say impossible, to administer. The same general principles would absolutely apply to any Federal system which might be laid out.

There is much to be said for the Wisconsin system in which the state has general supervision, the county organizations carry out the details of the maintenance work in accordance with state requirements, and the state repays the cost to the counties when the work is properly done. A one year's trial of this method has worked out quite well in Wisconsin. We cannot say that it has or has not worked out as well as would a system of exclusive state control. Under the plan of organization, long established for state-aid construction, county maintenance directed by the state seemed to be the logical method, and we will say that almost without exception the county organizations have cooperated wonderfully well and have gotten excellent results. Where they have not, our law gives the state department adequate remedies.

Patrol System—We believe in the patrol maintenance system. Patrol sections of proper length, whatever the character of the highway, should be placed in charge of a patrolman who is solely responsible to those above him for the condition of his section. We have established about 480 patrol sections on our 5000 miles of highway, varying in length from as little as six miles on very bad earth road stretches, to as much as 20 miles on some of the macadam truck patrol sections. We believe that the average patrol section should be not more than seven miles, if the road is an earth road in average condition. Sections may be longer or shorter than this, according to the character and condition of the road.

Patrolmen in Wisconsin were obtained through advertisements in local papers after the patrol sections were determined. Applicants were asked to appear at the county seat and were looked over and questioned by county authorities and a representative of the State Highway Department. Starting salaries were fixed at from $120 to $135 per month, and the patrolman is required to furnish a good team and a wagon. The county furnishes the remainder of the tools, consisting usually of a small four-wheeled road grader for two horses, a road planer or road drag, or both; plow, shovels, picks, brush hooks, etc. Patrolmen are required to sign a contract and to give a bond for $500. No very great difficulty was encountered in obtaining patrolmen, except in certain localities where a large amount of war work was being done. After the selection of the patrolmen, county road schools were held at each county seat at which the division engineer and the county highway commissioner explained in detail the methods to be used in patrol maintenance. A pamphlet on patrol maintenance was also published by the commission, giving instruction for the gang and patrol maintenance of the various types of road.

Of the 560 patrolmen originally hired, 75 were discharged and replaced before the end of the season. It was necessary in many cases to raise the compensation, so that at the end of the season the scale was from $120 to $140 per month. Next year, unless conditions change, we expect to pay more, especially for the better patrolmen. The patrolmen are engaged continuously during the maintenance season, which with us lasts about eight months. In the winter season we expect to use them a part of the time for winter hauling of surfacing materials and for snow removal, where the counties are forced to remove the snow owing to the failure of local units to do so. The patrolman's wagon is marked with the standard triangle and number, and he is required to wear a distinguishing badge, to display a flag when off the road during working hours, and to make daily and semi-monthly reports.

Experience With Patrolmen—In general, the patrolmen have more than justified our expectations. At least 65% of them have given excellent service. About 20% are on the division line between good and poor, and about 15% will not be with us next year. We have had a small percentage of sections which as a result of a combination of disasters have given us considerable worry. We believe that when a section threatens to become a continuous "hoodoo," the only thing to do is to take it in hand and devote the organization's time and money to it until it is brought up to standard. In 1918 we shall reduce the length of many of our patrol sections and thus increase the number of our patrolmen. This increase will probably be about 20% and will cut the average length of our sections from 9 to 7.5 miles.

We are trying to make the patrolmen's job an attractive one, and are going to make a specialty of paying the better men more money than the poorer ones, so that

ONE MAN, ONE TEAM AND FOUR-WHEEL ROAD MACHINE—WISCONSIN HAS FOUND THIS THE MOST EFFECTIVE MAINTENANCE TOOL

they will realize that good services are appreciated. We hope to develop an *esprit de corps* by providing certificates of merit, banners to be displayed on especially well-maintained sections, and bonuses for consistently good work to the good patrolmen. We want to make the patrolman's job one well worth while, for upon him rests the success or failure of patrol maintenance.

Very few complaints have been received that the patrolmen were loafing. There has been some of this, inevitably, but between the county highway commissioner's getting around almost daily, our division engineer or division maintenance engineer's visiting each patrolman about once a week and reports from travelers and neighbors, we have kept a pretty close check on the patrolmen's activities, and believe that there has been comparatively little shirking.

In addition to the patrol maintenance, we organized each county for a certain amount of gang maintenance. This includes heavy road machine grading; scarifying, shaping and placing light resurfacings on old gravel and macadam roads; also surface treatments. Roughly, the expenditure for maintenance has been divided, one-half for patrol maintenance and one-half for gang maintenance. The expenditures in 1918 were at the rate of about $250 per mile. The cost of patrol maintenance per mile on earth and gravel roads averaged $125, the remainder being expended for gang maintenance or maintenance of the more expensive surfaces, such as macadam.

Wisconsin made an error in distributing the funds available for maintenance to the counties pro rata with the state trunk highway mileage lying in them. The distribution of maintenance funds should be made by the state department on the basis of maintenance needs. Type of road and amount of travel, of course, determine the funds which should be used, not any fixed factor of road mileage, population or valuation, or even automobile ownership. Other states should not repeat our mistake.

It may be interesting to summarize briefly some of the conclusions we have reached as a result of one year's state maintenance. These may not be final, but they seem well founded on our experience so far.

We find that earth roads of light clay or loam are easy to maintain either by dragging and planing or with the road grader, providing we have a rain about every 10 days. Continued dry spells are almost as troublesome as continuous wet spells, especially on light soils.

The two-horse, four-wheeled blade grader is the most effective tool for earth and road maintenance. The road planers are the second most effective, but must be built much stronger than usually shown or sold, if they are to stand the pounding of constant use.

We are going to start an intensive campaign for applying a sand or gravel light surfacing, on earth roads which are sticky or slippery after rains. We have been astounded at the results from light (2-in. to 4-in.) sand and gravel coatings on heavy clay soils, if followed by patrol maintenance. This is probably the most valuable lesson we have gotten from this year's maintenance experience.

We have learned that well maintained earth roads need very little crown. The flatter and wider an earth road the better, if it has good drainage and is kept constantly smooth. The same is true for all other types.

On sand roads, we find that marsh hay and straw are effective if covered with sand at the time of application, and that sand prolongs by much the life of these materials. Cedar bark and cedar shavings are the best temporary sand coverings. Our tar-hay experiment on sand was quite successful, but this method of sand maintenance is entirely too expensive, costing at least $700 per mile per year to maintain a good 16-ft. composition surface. We believe that the economical thing to do with sands is to cover them with good clay or gravel as rapidly as funds permit. Tar-hay, hay, straw, and weeds wear out rapidly and are far more expensive in the long run than a clay or gravel permanent treatment under even very disadvantageous and expensive hauling conditions.

The roughest roads on the state trunk highway system have been the water-bound macadam roads which have been surface-treated in past years. It is probably theoretically possible to maintain a limestone macadam road with surface treatments, but with the instruments of maintenance in the way of man-power which we have to use in these days, effective results are very difficult to obtain. The untreated water-bound macadam roads maintained with light coatings of sand, pea gravel or stone screenings, or even with a road machine, have been more satisfactory than have the treated macadams that were not properly maintained from their construction. We expect as rapidly as possible to scarify all of our worn macadam roads, widen them to 16 or

GANG MAINTENANCE—UTILIZING CATERPILLAR TO HAUL TWO ROAD MACHINES WHICH BRING UP THE DIRT FROM BOTH SIDES

18 ft. and cover them with a coating of 2 or 3 in. of fine gravel.

We have about given up the water-bound stone macadam road as too expensive to maintain. Some of the penetration macadams bound with tar or asphalt have given much better service than expected, and have shown themselves superior in maintenance possibilities to any water-bound structure we have built. This is another reversal of a former opinion.

We have found that the most satisfactory cheaply built roads to maintain are the gravel roads. We have scarified many miles of old gravel roads and at a cost of $200 or less per mile have produced a surface very satisfactory and easy to maintain. The more experience we have with gravel, the more convinced we are that it is the lowest cost surfaced road, both to build and maintain, and much superior to water-bound macadam. We believe that the particles of gravel in the top 4 in. of a gravel road should not be larger than 1 in., and we would crush even finer, if it were not so expensive to produce fine crushed gravels. Gravel roads give the best and smoothest service without surface treatments. If it is necessary to treat them to eliminate dust use very light oils and don't try to build up a protective coat.

Horse-Drawn Maintenance Wagons Preferred

We have found trucks and tractors not generally satisfactory for patrol maintenance. Trucks give too much opportunity for "joy riding," are economical only when used for hauling, and then only when rapid loading and unloading facilities are available. Tractors give fair service, but to make them economical the sections must be so long that a part of the road lies undragged for too many hours after it gets in condition for dragging. It is a fact that with both the trucks and tractors if the patrolman starts as soon as a road is fit for dragging, on the long sections the road has become too dry before he completes the two round trips necessary. Furthermore, neither tractors nor trucks provide the ditch and shoulder maintenance that can be gotten with a team. We are distinctly going to discourage the use of both trucks and tractors in patrol maintenance except as supplements to team patrol, and stand by old Dobbin.

Summing up the maintenance results, we can say that on the state trunk highway system in Wisconsin, despite the fact that our construction has been cut to less than half of the normal, due to war conditions, the main roads in Wisconsin were never so good as they have been throughout this season. We estimate that in one year we have improved the average condition of the 5000 miles at least 50%. Competent estimates are that in the one year the increased number of miles per hour which can be safely averaged by auto over the state trunk highways is seven. This improvement and this increased mileage per hour means much.

It is not safe to make broad statements, because conditions as to soils and availability of materials vary so much in various states. Nevertheless, we believe that any state can equal or surpass this record at an average cost of about $250 per mile per year. If more money can be made available the first few years, so much the better. We have learned to have the greatest respect, which we did not entertain heretofore, for the less expensive methods of maintenance and construction. In fact, 1918 has taught us all in Wisconsin more than we have learned in several preceding years of routine construction.

We feel distinctly confident that if one year has enabled us to obtain the results which have been produced, a succession of years will give us a passable highway system at an expense within our means. Maintenance will bridge over the gap which there must be between our present practically unroaded condition and the ultimate system of adequate highways built to bear modern traffic, which all states are going to have as fast as these systems can be financed and built.

Probably the best commentary on the maintenance results of this year is the fact that at the November meetings of our county boards many of the counties adopted county truck highway systems to be maintained in 1919 by the counties by the patrol system. It is probable that the total mileage on these county systems is half that on the state system, so that Wisconsin will have 7500 miles of patrolled highways in 1919.

A Plea for State Maintenance

The states which are doing nothing to maintain through routes until they are constructed are making a grave mistake. Much can be done with the most unpromising system of roads if moderate maintenance funds are expended efficiently under the patrol system. It must be conceded that earth roads and the temporary surfacings of light types fail upon certain occasions to give 100% service every day in the year, but on a surprisingly large number of days they can be made practically as good as any road. While they are not the ultimate, the man who waits for the ultimate is apt to find it upon the other side of the Styx.

If any state expects to build a complete modern state trunk highway system within a year or two, it need not establish state patrol maintenance; if it cannot, we urge it to get into the real maintenance game and wrest the best results possible out of what it now has.

If a state as yet unroaded, with insufficient funds available for construction on a large scale, wishes to do the most for its roads and for its people, we are convinced that for a few years it can do it by expending its money largely in intelligent maintenance, good grading and temporary surfacings over the entire system, rather than by building a few miles of high-class construction in isolated stretches. In the average state $2,000,000 a year will adequately maintain and do much to improve a road system of 7000 miles or more; it will build each year about 80 miles of modern road.

Eventually, we must all build certain of our main highways of the highest type of construction. We must immediately construct in this manner certain stretches which cannot be maintained so that they may bear the traffic which does or should use them; but the great mass of roads, even the most important roads, in the average state must wait several years before they can be rebuilt adequately. Why not recognize the fact and devote less state funds to construction and more to maintenance, not only of the inadequate road structures already built, but of the common earth roads as yet untouched?

I know this is unorthodox, especially coming from a state highway engineer, but if it be treason, make the most of it. For the next few years, if we have our way, Wisconsin is going to devote herself largely to maintenance and temporary grading, draining and surfacing.

When we do spend large sums of money for final construction in that period, it will be for adequate widths of concrete or brick or whatever type may surpass these in final economy and ease of maintenance. Those roads which cannot be maintained unless surfaced, and which we are financially unable to build of the final type, will be built largely of fine crushed gravel, surfaced at least 16 ft. wide. This, we are convinced, is the cheapest and the most maintainable of all low-class surfaced roads.

Ideas Gleaned from Other States

These conclusions are not entirely original with us. To the other Western states, especially Michigan, Minnesota and Iowa, we owe many of the fundamental principles upon which we have built, possibly, a more adequate maintenance structure.

It will be noted that we have said little about construction, which was at the outset urged as the basic reason for the selection of a state system. This is a considered omission. Construction will take care of itself as fast as Congress, the legislatures and the people can be persuaded to provide the money. In the meanwhile, we urge all states to get a proper state system laid out, to concentrate as much as possible of their construction funds upon it, and to build adequately when they do build. Pending, however, the final complete construction, which will be delayed many years in nearly all states, the important things to do are so to maintain the system, and so to remedy temporarily but adequately the bad spots and the real impediments to travel upon it, that the whole system is safely and comfortably passable throughout its length from the day of its establishment.

Not the stoppage of construction, but good construction—reduced a little, if necessary, to provide for the immediate maintenance of the whole system—is the burden of this effort.

Report on Terminals for Philadelphia-Camden Bridge

Washington Square in Philadelphia was recommended by Prof. Warren P. Laird, consulting architect for the interstate bridge commissions of New Jersey and Pennsylvania, as the site for the western terminus of the proposed Delaware River bridge. The Camden terminus, he finds, should be at Court House Square. At these two points, respectively, seven and five channels of access or exit would be available. The recommended bridge location, Professor Laird stated in a report to the Pennsylvania commission recently, takes into account the produce traffic from New Jersey to Philadelphia, the city's harbor facilities, industrial activities, and æsthetic considerations. It affords the bridge a suitable setting as a great public monument. Direct trolley connection of Philadelphia with the Camden railway terminals would be possible. A total expenditure of $15,000,000 to $20,000,000 would be required to build the bridge.

Commission Control Does Not Remove Hazard of Utility Investment

Ruling in Indianapolis Water-Rate Case Makes Company Share War Risk and Modifies Former Commission's Position

By Leonard Metcalf
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The author writes of the Indianapolis case with the knowledge gained through long and intimate connection with it as consulting engineer to the company.—Editor.

THE recent decision of the Public Service Commission of Indiana on "The Application of the Indianapolis Water Co. to Revise and Increase Water Rates," rendered Oct. 17, 1918, is of importance to owners, operators and investors in public utilities in the State of Indiana, because it appears to make clear that the Indiana commission purposes to stand hereafter on investment cost, rather than upon the broad concept of value as laid down in past decisions by the United States Supreme Court. To the general public it is of importance as showing this commission's trend of thought upon valuation methods, its concept of "fair value," and its view of the proper placing of the burden of hazard.

Part of War Hazards Put on Utilities

Hitherto, it has often been asserted that the existence of the Public Service Commission eliminated the burden of hazard under which the corporation operated, and that the corporation must therefore be content with a lower rate of return, corresponding to this reduced hazard. The decision of the Indiana commission in the Martinsville Telephone Co. case, followed by the recent Indianapolis Water Co. rate decision, both quoted below, makes clear the fallacy of this assumption and indicates that in the State of Indiana the hazard of reduced revenue from investment must be shared, if not in the main borne, by the corporation, even though the rate of return allowed by the commission in normal times may appear to many to assume or be more in keeping with that of a reasonably assured or protected investment than of one of some hazard. These decisions are:

"However, to this commission it appears fundamental that there should be an equitable distribution of the burdens of the war and that within reasonable limitation this burden should be shared by the utility as well as the public. This consideration is one of the elements entering into the determination of the amount of return." (P. S. C. I., No. 3962, Martinsville Telephone Co.)

"Under Section 122 the commission is not at all concerned with the fixing of rates which will provide a fair return upon the reasonable value of the property, but is concerned with the single purpose of determining temporary rates which will 'prevent injury to the business or interests of the people or any public utility of this state.' . . Is there danger of impairment of credit—of insolvency? Is its service in peril? Then there must be determined, obviously, not what is a reasonable return but what relief is necessary, in order to prevent injury to the utility, to protect its property, to meet its extraordinary but just financial needs, to prevent insolvency, to maintain its credit, to provide adequate service—and which at the same time will not impose unjust burdens on the people." (P. S. C. I., No. 3868, Indianapolis Water Co.)

A brief review of the facts leading up to the Indianapolis decision, and some references to the decision itself, may be of interest.

On Mar. 24, 1916, the Indianapolis Water Co. prayed for authority to issue certain securities on the strength of previous outlay. On the following day the City of Indianapolis filed objections to the granting of the company's petition. On Nov. 20, 1916, the hearings before the Indiana Public Service Commission began, and were continued for several weeks, detailed evidence being presented by the company as to the original cost, the reproduction cost and the fair value of the property.

On Mar. 15, 1917, the commission submitted its findings in an able opinion (No. 1400), written by its then chairman, Thomas Duncan. In substance, the commission reported that "the cost of reproduction new less depreciation" amounted to $9,670,191; and that "there has been invested in this property, in actual money, excluding going value, more than $8,000,000 . . . . and an appreciation in the value of the real estate of at least $1,500,000. Under the law, in arriving at the value of this property this appreciation of real estate should be added to the actual expenditure."

Upon this basis the value would have been $9,500,000. The commission also reported that "the present owners have invested in this property at this time $9,740,768.75"; and that "the property . . . could not be duplicated today for less than . . . $12,500,000."

Value of Property Fixed by Old Commission

The commission finally fixed "the value of the . . . property . . . used and useful, at not less than $9,500,000"; found that the annual sum of $1,133,465 was "necessary for the successful operation of this property" as of date Dec. 31, 1916; and prescribed certain rates to be put into effect, which it was assumed would, on the average, produce the income reported necessary by the commission. With reference to the rate of return, the commission found that "the only guide we have as to what the rate should be is that it should be such as to invite the investment of capital in like enterprises in such volume as to meet the public need. In this proceeding we have allowed a rate of 7%." In comment upon this rate the commission said:

"The evidence taken on the hearing of this matter discloses clearly that the rate agreed upon will not yield the needed revenue during the first year of operating under such rate. It is believed, however, by the commission, that growth of the company's business and possible economies that may be effected will enable the company under this schedule of rates, tolls and charges, to earn 6% dividend on its stocks, and that the earnings under the rates will gradually increase. It is difficult to establish any rate that will yield, the first year of its operation, the needed revenues of a company that is continuously growing and which rate will not, in the following years, be excessive. It is better to establish a rate that will yield slightly less than the needed revenues and that will remain in force and effect until it earns over a series of years an average annual return that equals the needed annual revenues of the company."

In compliance with the old commission's order, contained in this opinion, No. 1400, the Indianapolis Water Co. put the prescribed rates into effect on May 1, 1917, and when the first year had passed, finding that the prescribed schedule failed to earn even the 6% rate anticipated by the commission, and that it was facing a seriously diminishing revenue, which it feared and believed would seriously impair its credit and borrowing capacity, petitioned the Public Service Commission of Indiana, on May 18, 1918, for revision of and increase in its rates.

In this interval, it is to be noted, the personnel of the old Public Service Commission, which had been responsible for Opinion No. 1400, had almost completely changed and, as will appear hereinafter, with the coming of the new commission a distinct change in viewpoint and policy was enunciated.

Hearings were subsequently had before the new commission, and resulted in the handing down of its Decision No. 3868 under date of Oct. 17, 1918, to which reference follows, as it appears likely that, if the opinions expressed in this decision shall hereafter govern the actions of this commission, the higher courts will be appealed to later by some of the corporations affected, when world conditions are better stabilized.

After some discussion with reference to the basis of its review of the growing difficulties of the Indianapolis Water Co., due to the new schedule of rates and the growing burdens of the war, the commission concluded to predicate its action upon its authority, under Section 122 of the Indiana Utility Act, to give relief in emergency cases. The commission then took up the need of the company for relief, based upon the earlier finding of value, contained in Opinion No. 1400 of the old commission, modified by the change in conditions which had taken place in the interval from Dec. 31, 1916, to Apr. 30, 1918, refusing to reopen at this time the question of modification of basic value due to the war, giving weight now only to the extraordinary conditions faced by the company.

Dissent from Findings of Old Commission

The new commission first states that the old "commission in Case No. 1400 accepted the fair present value ruling, the application of which was controlled largely by the theory of cost-of-reproduction-less-depreciation. This has been and is now the prevailing method of valuation in Indiana"; but the commission hastens to call attention to its own different view:

"To a commission not well schooled in the philosophy and fundamentals of utility regulation, it would seem that a continued disposition toward this method of valuation would rapidly lead into unfathomable depths of speculative valuation and create a thoroughly artificial and unjust basis for property values."

The new commission concludes that:

"Of necessity, therefore, there can be no better guide to, or basis for, rate-making valuations than honest and prudent investment. . . . It is sufficient to say, however, that mere striving toward the attainment of prudent investment should produce a larger measure of substantial justice than the makeshift measures of evaluation in vogue during recent years. The commission, of course, does not assume the radical position that there should now be a sudden change in methods of evaluation, but it does believe that the goal should be kept in sight, and should be attained by measured steps in that direction. . . . But prudent investment should be the controlling factor."

Question of Real Estate Appreciation

The present commission dissents further from its predecessor's conclusion that under the law the appreciation of real estate should be added to the actual expenditures in arriving at a fair value, and urges that "if prudent investment is in ratemaking to be the controlling factor in determining utility values, what justifica-

tion can there be for capitalization of the unearned increment?" overlooking the fact that, unless the owner of the property is permitted to enjoy this increment, as has heretofore been the case under court rulings, there is denied to him the return which all other investors enjoy, and he is thus discriminated against; and, further, that if change in public policy is to be dictated in this direction, past rates of return must be increased to induce capital to continue its interest in such investments, with the reduced rate of return which would result from the denial to capital of this hitherto enjoyed increment in value. This practical side of the problem seems to have been overlooked.

In a matter so vitally touching the public welfare, one may seriously question, without discourtesy to the present Public Service Commission of Indiana, the soundness of a discussion as greatly at variance with financial experience the world over as it is with a long and consistent line of Federal and state Supreme Court decisions, founded upon the law and general human experience. It seems highly probable that if it determine the future position of the State of Indiana and course of action of its commission, it will lead to costly litigation which, if past precedent be a safe guide, will enforce a return of the commission to its earlier views, and incidentally involve the cost to the poor consumer of this further litigation. Human progress is beset with just such difficulties, and the direct middle path is reached often only after attempting the devious, sometimes alluring, paths on its margins. But it is well to heed the lesson taught by the cost of unnecessary retracing of devious trials, already explored and well blazed.

The sincerity of view and the desire of the Public Service Commission to do full justice to the corporations as well as to the people of the State of Indiana are not here called into question, but merely the soundness of some of its recent conclusions and enunciation of principles.

Allows Six Per Cent. on Its New Valuation

The commission then analyses the revenue and operating expenses of the company for the past year, and forecasts probabilities for the immediate future. It refuses to sanction some of the salaries and expenditures of the company and properly eliminates its war relief and charitable contributions, to an aggregate amount of approximately $31,000. It details some of the important items of increase in cost of operation, for coal, electric power, oil, gasoline, alum, chlorine gas, freight and labor, and finally concludes that an increase in revenue is justified, of approximately $80,000, 16 per cent, of the operating expenses for the year which ended Apr. 30, 1918, after subtracting the deductions above referred to. Of this $80,000 increase, approximately $13,000 is estimated, by the commission, to be earned through the normal increase in revenue, thus reducing the net increase permitted by it to 13.4% of the operating expenses allowed.

The commission says:

"In view of the present uncertainty of future economic conditions, the impossibility, even by most careful calculation, of accurately prophesying future cost, and in order to maintain the credit of the company and to prevent injury to its business and interest, the commission believes that relief should be granted; that in so far as it can be reasonably calculated the measure of relief should be sufficient to provide during the war period a return of 6% on property values amounting to $9,664,000."

It wisely places this burden upon the large consumers of water, whose rates now appear to it to be slightly below an equitable level.

It will thus be seen that in effect the commission concludes that the demand for relief from the danger of impairment of credit of the company will be met by granting it increase in rates sufficient to realize a 6% rate of return upon the value fixed by the commission, though it does not contend that this return is a fair one upon the fair value of the property, and it is obvious that the basic value used in no wise reflects the change in conditions due to the war or the rate of return found necessary by the old commission and in accord with other rulings of the present commission. From the point of view of the removal of the danger of the present situation to the corporation, and the value fixed by the commission upon this property, the action of the commission would seem to be fair, but it is important to note that it obviously does not meet the common assumption that commission control removes the hazard of investment and that such an obligation is specifically disclaimed by this commission in its decisions quoted above.

Asphalt Pavements Constructed in Rainy Weather

"GIVEN the essentials of a suitable subfoundation, and particularly a well drained asphaltic concrete base, it would seem that the wearing surface or 'topping' may be put down in any conditions of weather that the workmen engaged in laying it can tolerate," is a statement made in the Oct. 18 issue of the *Surveyor* of London, by T. G. Marriott, engineer, the Limmer and Trinidad Lake Asphalt Co. The conclusion is drawn from experience on work at Oxford, England, in 1915-16, when laying of asphalt was continued practically throughout a year which had a record for rainy days.

The work in question comprised the laying of about five miles of 4½-in. Trinidad asphalt macadam on the principal motor omnibus routes of the city. The pavement was laid in two coats, directly upon the existing roadbed, after the usual scarifying and rolling to the required level. No Portland cement concrete was used, and the contract provided for the continuous prosecution of the work during the winter months, subject to the discretion of the city engineer.

Complete records were kept by the Radcliffe Observatory of Oxford of the amount of rain and snow which fell during the period of construction. This extended from the middle of July, 1915, to the middle of June, 1916, or through 11 months, thus covering all seasons. These records show that there were 183 rainy days and 33 days when it snowed. Coupled with this, the climate of Oxford is generally damp and raw and unfavorable for laying asphalt. The subsoil of the road was found to consist largely of valley gravel and there was therefore a good foundation for the work.

From this experience Mr. Marriott concludes that modern, mechanically mixed asphalt will adapt itself to all-year-round work.

ENGINEERING LITERATURE

A REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

An Exceptionally Complete Handbook

CONCRETE ENGINEERS' HANDBOOK: Data for the Design and Construction of Plain and Reinforced Concrete Structures—By George A. Hool, S.B., Professor of Structural Engineering, The University of Wisconsin, and Nathan C. Johnson, M.M.E., Consulting Concrete Engineer, New York City; assisted by S. C. Hollister, B.S., Research Engineer, Corrugated Bar Co.; with Chapters by Harvey Whipple, Adelbert P. Mills, Walter S. Edge, A. G. Hillberg and Leslie H. Allen. New York: McGraw-Hill Book Co., Inc. London: Hill Publishing Co., Ltd. Cloth; 6 x 9 in.; pp. 860; illustrated. $5.

The 865 relatively small-type pages of this book demonstrate the use of unusually sound judgment by the well known authors in carrying through their definite purpose to "make available in concise form the best of present-day knowledge concerning concrete and reinforced concrete, and to present complete data and details, as well as numerous tables and diagrams, for the design and construction of the principal types of concrete structures." Indeed, the book is much more than a handbook. The data are, on the whole, presented in concise form, the voluminousness resulting from completeness of treatment, with illustrative examples.

It is probable that engineering educators, in view of the new attitude toward their problems resulting from their war experience, and the call for specific knowledge such as is voiced by Dr. Mann (see p. 1068 of last week's issue) will consider favorably the possibility of using this book as a text for instruction in the whole subject of reinforced-concrete construction.

The book is divided into 19 sections, treating the subject matter in fairly logical order, except where the section on floor surfaces precedes the sections on properties of mortar, concrete, and reinforced concrete. The sections are: (1) materials; (2) general methods of construction; (3) construction plant; (4) concrete floors and floor surfaces, sidewalks, and pavements; (5) properties of cement, mortar, and plain concrete; (6) general properties of reinforced concrete; (7) beams and slabs; (8) columns; (9) bending and direct stress; (10) moments in rigid building frames; (11) buildings; (12) foundations; 13) retaining walls; (14) slab and girder bridges; (15) concrete floors and abutments for steel bridges; (16) arches; (17) hydraulic structures; (18) miscellaneous structures, and (19) estimating. The five appendices are on standard specifications and tests for portland cement; working stresses; rules pertaining to flat-slab design according to various city ordinances, the Am. Soc. C. E. special committee and the standard building regulations of the American Concrete Institute; standard notation; and extracts from report of the Joint Committee of the American Concrete Institute and Portland Cement Association on concrete barges and ships.

Especially well handled in the first two sections are the discussions on money values, the effect of water on concrete, the theory of voids, the proportioning and checking of materials on the job, the placing of concrete, waterproofing, form design, with tables and diagrams; bending and placing steel. Harvey Whipple is the author of complete data on concrete stone, block, and brick, including details of manufacture.

The discussion of construction plant, while concise, contains many valuable data on the preparation of the concrete aggregates, quarrying, crushers, screening and washing. It gives the impression of first-hand information. Strong emphasis is placed on the possibilities of economy. Similarly, the section on concrete floors is exceptionally adequate in its treatment of this relatively new and important problem. Full, practical details of construction are followed by a discussion of remedial measures to be adopted to repair floors where necessary. A free use of micrographs tends not only to increase interest, but to add to exact knowledge.

Adelbert Mills is the author of Sec. 5 on the properties of mortar and concrete. He includes good comparative statements of the results of tensile and compressive tests, and introduces the elements of cost analysis. He recommends that the usual specification for sharp sand be omitted. Relatively few results of experiments are reproduced, the most valuable and authoritative apparently having been selected. The section forms a valuable collection of the results of recent exhaustive investigations condensed into concise, definite conclusions.

This comment also applies to the discussion of general properties of reinforced concrete in Sec. 6. In Sec. 7 the beam-and-slab theory is completely and concisely developed, with illustrative examples and useful diagrams; included is a good article on the ratio of length to depth of beam for equal strength in moment and shear, and on the economical proportions of rectangular beams. Sec. 9, on bending and direct stress, contains useful diagrams, including treatment of tension over part of the section, and also Wolfe's graphical method for rectangular or hollow circular columns under eccentric load.

In the full treatment of moments in rigid building frames, based upon the slope-deflection method, valuable equations and diagrams developed for practical cases are presented. The fact that high bending in columns for special cases of loading may occur, and the idea that maximum stress conditions in building frames must be considered, suggests that building-frame analysis lags far behind bridge-truss analysis in this respect. The text includes criteria for maximum combined stresses in columns, and should aid materially in developing this feature in future design.

Walter S. Edge is the author of a section on flat-slab construction. In it are included examples of the computation for various flat-slab rulings and systems (such as the Akme, Corr-Plate, Pittsburgh, Chicago, A. C. I.) and including extensive tables. Various systems of unit-built construction are also illustrated. In the discussion of roofs, the methods of preventing condensation are fully considered and equations for cases of rigid roof frames are given.

The treatment of retaining walls includes cantilever wall analysis diagrams, also counterforted walls in very complete detail, with illustrative problems. Slab-and-girder bridges also receive adequate treatment, with many illustrations.

The elastic theory of arch analysis as developed by Turneaure and Maurer is presented, and a nearly complete reproduction is made of Victor Cochrane's paper on arch design, including the diagrams for influence lines. Arch construction and arch centering are both fully presented.

Dams are treated by A. G. Hillberg, who gives a concise but complete presentation of the subject, including preliminary studies, design of foundation, dams of gravity section, a full discussion of the effect of uplift, tabular form of final computation, etc., and including arch dams, spillways, overflow dams, and sluices. The matter on siphon spillways is new and valuable. The sections on reservoirs, standpipes, and small tanks are good, the problem of dome analysis being treated, with an illustrative example. Tables of loads on pipe in ditches are included. The section on estimating is by L. H. Allen, and includes unit costs with examples, quantity with general suggestions.

The typographical work is satisfactory, but in many cases the lettering on the diagrams is hard to read, the reduction being too great, or the original lettering too small. The division into sections and numbered articles instead of chapters is a departure from usual practice. References to outside sources would be improved if dates as well as volume numbers were included. It is unfortunate that the names of the various authors of special sections were not included in the table of contents.

Another Cost Data Handbook

HANDBOOK OF MECHANICAL AND ELECTRICAL COST DATA: Giving Shipping Weights, Capacities, Outputs, and Net Prices of Machines and Apparatus, and Detailed Costs of Installation, Maintenance, Depreciation and Operation, Together with Many Principles and Data Relating to Engineering Economics—By Halbert P. Gillette, Consulting Engineer, M. Am. Soc. C. E., and Richard T. Dana, Consulting Engineer, M. Am. Soc. C. E. New York: McGraw-Hill Book Co., Inc.; London: Hill Publishing Co., Ltd. Leather; 4 x 7 in.; pp. 1716; illustrated. $6.

The many who have found useful the long line of cost data handbooks published by these two authors in the past quarter century will welcome this accession to the list, and gladly recommend it and its predecessors to others. The present work "is designed to be a companion volume," say the authors in their preface, "to our two civil engineering books, the 'Handbook of Cost Data' by Gillette, and the 'Handbook of Construction Plant Data and Its Cost,' by Dana. . . . These three handbooks are so written as not to overlap, and can be used to supplement one another."

Nearly 150 pages of the present volume, or 9% of the total space, are devoted to discussion of "General Economic Principles," (81 pp.) and of "Depreciation, Repairs and Renewals" (63 pp.). As each page contains 500 words or more and the subjects are systematically presented, these chapters are good-sized monographs. They deserve careful attention, particularly on the part of those engaged in utility valuation. A table of "Estimated Lives in Years in Plant Units," compiled from various cited authorities, occupies seven pages of the second of these chapters, besides which other physical data for use in computing depreciation, as well as tables and diagrams for the mathematical process itself, are given.

After these discussions the authors take up in detail such structures, plants and operations as buildings, chimneys, steam and hydro-electric power plants, wire systems, gas works, pumps and pumping, moving and installing machinery, and fuel handling. Much of the material, probably most of it, has been gathered from a variety of printed sources, but that is to be expected in a book of this kind. Thanks are due the authors for their wide search, their industry and their skillful presentation of a vast mass of cost data which will be useful to civil as well as to mechanical and electrical engineers.

The City Cleansing Service

MUNICIPAL HOUSE CLEANING: The Methods and Experiences of American Cities in Collecting and Disposing of Their Municipal Wastes—Ashes, Rubbish, Garbage, Manure, Sewage, and Street Refuse—By William Parr Capes, Director New York State Bureau of Municipal Information, and Jeanne Daniels Carpenter, A. M., LL. B., Boston University, Expert in Economics and Municipal Research; With an Introduction by Cornelius F. Burns, President of New York State Conference of Mayors and Other City Officials. New York: E. P. Dutton & Co. Cloth; 7 x 10 in.; pp. 232. $6.

Much useful information on street cleaning and the collection and disposal of city wastes is here given. The text is chiefly a compilation from various accredited sources, skilfully arranged, and in places interpreted for lay officials. Some commonly and long accepted facts and opinions are placed in quotation marks and credited to one of hundreds of engineers who state them every day in their reports, and some more or less chance remarks or descriptions of experimental or little-used procesess are brought forward with equal solemnity—as is almost inevitable in such a compilation of technical data by persons not versed in the art or the science being treated. As a rule, these merely detract slightly from the value of a good piece of compilation and popular interpretation. Rarely does one find so sweeping and unwarranted an assertion as this, from p. 81: "There is almost an unanimity of opinion now in favor of the use of mechanically operated fine screens." Besides the text, the volume contains a considerable amount of tabulated information from the larger cities of the country on street cleaning, refuse collection and disposal and sewage disposal. This material was collected by the authors for the organization with which they are connected. The dates to which these and most of the other data of the book apply are not given. The volume is handsomely made, but the price seems exorbitant.

British Industrial Control in War Time

WAR-TIME CONTROL OF INDUSTRY: The Experience of England—By Howard L. Gray, Professor of History in Bryn Mawr College. New York: The Macmillan Co. Cloth: 6 x 9 in.; pp. 304. $1.75.

Progressive measures for the control of British industry, from the beginning of the war to the close of 1917, are outlined in this interesting volume. In the concluding chapter some comparisons are drawn between control in England for three years and in the United States for less than a year. In several respects the comparison is favorable to this country—which had the benefits of British experience and fewer handicaps. The book contains chapters on control of railways, munitions, labor, coal mines, wool and worsteds, hides

and leather, shipping, food and agriculture. The portions of the book dealing with labor are impressive. With no apparent prejudice one way or the other on the part of the author, the narrative indicates that a large part of the difficulties experienced in dealing with labor were due to a conviction on labor's part that profiteering not only deprived it of its due reward in wages but also increased the price of food. It was largely because of this cause that the Government took over the railways and many of the munitions plants, and exercised a wide measure of price control.

Our Army Engineers in France

AMERICAN ENGINEERS BEHIND THE BATTLE LINES IN FRANCE—By Robert K. Tomlin, Jr., War Correspondent for the McGraw-Hill Publications. New York: McGraw-Hill Book Co., Inc. Cloth; 9 x 12 in.; pp. 91; illustrated. $2.

Those who have followed with growing interest Mr. Tomlin's war engineering articles from France as they appeared in *Engineering News-Record* during the past year will welcome the republication in a single handy volume. Those who have not seen some or all the articles now have an opportunity to get them all.

The author was for some years managing editor of *Engineering Record* and *Engineering News-Record*. He went to France solely for the purpose of presenting war activities from the engineering viewpoint. Among the subjects treated are dock, road and railway building, water-supply, map making from the air and on the ground, and the work of the Army engineer schools. The many illustrations add to the interest and forcefulness of the text.

British Public Health Problems

HEALTH AND THE STATE—By William A. Brand, M.D. (State Medicine), Lecturer on Forensic Medicine, Charing Cross Hospital. New York: E. P. Dutton & Co. Cloth; 6 x 9 in.; pp. 354. $4 net.

Primarily a plea for a British ministry of health, to be concerned chiefly with research, and for coördinating and strengthening local health administration, this volume contains a careful examination of preventable or reducible causes of death, with particular reference to environment, which latter the author holds to be dominant. Much attention is given to British national insurance and medical treatment, which the author considers weak both as regards legislation and administration. The book deserves the attention of American public health students and administrators.

Dictionary of Shipbuilding

MODERN SHIPBUILDING TERMS: Defined and Illustrated—By F. Forrest Pease, Staff Instructor, Education and Training Section, United States Shipping Board, Emergency Fleet Corporation; Including a Series of Photographs Showing the Progressive Steps of Construction, Together with an Appendix on Electric Welding. Philadelphia and London: J. B. Lippincott Co. Cloth; 5 x 8 in.; pp. 143; illustrated. $2.

Setting himself the task of explaining to the shipyard or shipping novice the peculiar terms that make up the nomenclature of the subject, the author put together a very instructive list of words and definitions. It compares favorably with other recent works of similar purpose. The hurried needs of the day must serve as excuse for the imperfections that appear in even a cursory glance through the work, though even the publishers' editing might have improved on the definition of "Galvanizers," which reads, "Same as outside, except that the pieces galvanized are larger than generally galvanized."

Photographic plates showing ships in process of construction are placed at the back of the book, and references in the text, together with reference letters on the views, direct the reader to parts representing the terms defined. Compared with distributed text illustrations, as in the old Webster dictionary, this arrangement is less convenient, but its instructional value is evident. Special care seems to have been given to this illustrative supplement, embracing nearly 70 full-page plates.

Work of the United States Forest Service

OUR NATIONAL FORESTS: A Short Popular Account of the Work of the United States Forest Service on the National Forests—By Richard H. Douai Boerker, M.S.F., Ph.D. Arboriculturist Department of Parks, City of New York. New York: The Macmillan Co. Cloth; 6 x 9 in.; pp. 238; illustrated. $2.50.

After a general introduction of some fifty pages reviewing the importance of forestry and allied matters, the author presents a detailed but thoroughly readable account of our many and vast national forests. Their creation, organization, administration and protection from fire, trespass, insects and erosion, are described, and also the sale and rental of forest resources. Handsomely presented, well chosen illustrations add to the interest and value of the book. The typography is excellent. An index is needed, but there is a detailed "Contents."

The Development of Official Statistics

THE HISTORY OF STATISTICS: Their Development and Progress in Many Countries; In Memoirs to Commemorate the Seventy-fifth Anniversary of the American Statistical Association. Collected and Edited by John Koren. New York: Macmillan Co. Cloth; 6 x 9 in.; pp. 739. $7.50.

As these historical surveys and reviews of the present status of official statistics of nearly all the leading countries engaged in the war were planned before the conflict began, it is little short of marvelous that it was possible to secure them before the war had closed. The volume opens fittingly with a brief address on "The American Statistical Association, 1839-1914," by John Koren, president, who was also editor of the book. It continues with a comprehensive review of "Seventy-Five Years of Progress in Statistics: The Outlook for the Future," by S. N. D. North, ex-president of the association named and ex-director of the United States Census. Next, eminent statisticians in the various countries covered review the history and development of official statistics in Australia, Austria, Belgium, Canada, Denmark, France, Germany, Great Britain and Ireland, Hungary, India, the Netherlands, Norway, Russia, Sweden, the United States and its several states. Promised articles on Italy and Japan were held up by the war. A thoroughgoing index, so essential to the full usefulness of such a work, is provided. The volume is a worthy memorial to the American Statistical Association, which has played so large a part in the encouragement and development of statistical science.

Progress Report on Run-Off

The November *Journal* of the Boston Society of Civil Engineers (715 Tremont Temple, Boston, Mass.; 50c.) devotes 35 pp., or nearly its entire space, to a progress report of the society's committee on run-off. Besides a short glossary, there are sections on "The Use of the Current Meter in Stream Gaging," "The Effects of

Ice on River Discharge," "Methods to be Used in Compilation of Data Analysis of Run-Off Records," all by C. H. Pierce, and "The 0.2 and 0.8 Method of Current Meter Measurement in Power Canals," and "Precipitation, Evaporation and Run-Off," both by Arthur T. Safford, chairman of the committees. Discussions of these progress papers are desired.

Civil Employment of Soldiers

The Federal Board for Vocational Education is distributing two series of pamphlets designed to promote the restoration of soldiers and sailors, both sound and disabled, to gainful occupations in civil life. There are separate pamphlets addressed to the men, to their families and to American employers of labor. Some of the pamphlets tell of a plan of Federal vocational education. Those wishing information should address the board mentioned above, at Washington, D. C.

PUBLICATIONS RECEIVED

[So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor the price is stated in each entry. Where no price is given, it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be obtained without cost, at least by inclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or in case of books or papers privately printed, then to the author or other persons indicated.]

THE A-B-C OF AVIATION: A Complete, Practical Treatise Outlining Clearly the Elements of Aëronautical Engineering, With Special Reference to Simplified Explanations of the Theory of Flight, Aërodynamics and Basic Principles Underlying the Action of Balloons and Airplanes of All Types. A Nontechnical Manual for all Students of Aircraft—By Captain Victor W. Page, Sig. R. C., A. S. New York: The Norman W. Henley Publishing Co. Cloth; 6 x 9 in.; pp. 257; illustrated. $2.50.

AIRPLANE CHARACTERISTICS: A Systematic Introduction for Flyer and Student and for All Who Are Interested in Aviation—By Frederick Bedell, Ph. D., Professor in Physics, Cornell University. Ithaca, N. Y.: Taylor and Co. Cloth; 6 x 9 in.; pp. 121; illustrated. $1.60.

AMERICAN SOCIETY FOR TESTING MATERIALS STANDARDS: Issued Triennially, 1918. Philadelphia, Pa.: University of Pennsylvania. Cloth; 6 x 9 in.; pp. 858; illustrated. To non-members, Cloth, $9, Half-Leather, $10; To members, for extra copies, Cloth, $6, Half-Leather, $7.

This is the first publication of the so-called A. S. T. M. Standards to be issued on the triennial plan separate from the society's year book. It contains the standard specifications already adopted, including steel, wrought iron, cast iron, nonferrous metals, cement, etc.; standard tests of various kinds; information on publication and personnel of standing committees, and a good index.

ASPHALT RELATED BITUMENS, AND BITUMINOUS ROCK IN 1917—By John D. Northrop. Washington, D. C.: U. S. Geological Survey. Paper; 6 x 9 in.; pp. 18; illustrated.

DESCRIPTIVE GEOMETRY—By H. W. Miller, M. E., Revised in 1917 by The Department of General Engineering Drawing in the University of Illinois, Urbana, Ill. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 5 x 7 in.; pp. 169; illustrated. $1.50.

THE ECONOMICAL USE OF COAL IN RAILWAY LOCOMOTIVES: Prepared under the Direction of a Committee Consisting of J. M. Snodgrass, Major E. C. Schmidt, H. H. Stoek, S. W. Parr and C. S. Sale. Urbana, Ill: Engineering Experiment Station. Paper; 6 x 9 in.; pp. 71; illustrated.

ELEMENTARY MATHEMATICAL ANALYSIS: A Text Book for First-Year College Students—By Charles S. Slichter, Sc. D., Professor of Applied Mathematics, University of Wisconsin. Second Edition, Revised and Entirely Reset. New York: McGraw-Hill Book Co., Inc. London: Hill Publishing Co., Ltd. Cloth; 5 x 7 in.; pp. 489; illustrated. $2.50.

FACTORS FOR OBTAINING CUBIC YARDS ON SLOPING Cross Sections From Cubic Yards on Level Cross Sections; Base Widths and Vertical Heights on Level Cross Sections With Zero Crowns—Designed by Arthur Alvord Stiles, State Reclamation Engineer of Texas; Supplement to Bulletin No. 5 of the State Reclamation Department, Entitled "Tables of Cubic Contents of Levee Embankments, June, 1917." Austin, Tex.: State Reclamation Department. Paper; 6 x 9 in.; pp. 25. Sent free on request. [The supply of Bulletin No. 5, to which this is a supplement, is exhausted.]

FINANCIAL STATISTICS OF STATES, 1917—Washington, D. C.: Bureau of the Census. Paper; 9 x 12 in.; pp. 178.

FLOW OF WATER THROUGH ONE AND ONE-HALF INCH PIPE AND VALVES—By Frederick W. Greve, Jr., Assistant Professor of Hydraulics. Bulletin No. 1, Engineering Experiment Station. Lafayette, Ind.: Purdue University. Paper; 5 x 9 in.; pp. 21; illustrated.

About 40 ft. of "ordinary black commercial water-pipe" in two approximately equal lengths were tested; also the same pipe with standard brass valves inserted between a gate, a globe and a check valve, singly.

THE FUSIBILITY OF COAL ASH AND THE DETERMINATION OF THE SOFTENING TEMPERATURE—By Arno C. Fieldner, Albert E. Hall, and Alexander L. Feild. Washington, D. C.: Bureau of Mines. Paper; 6 x 9 in.; pp. 141; illustrated. 20c. from Superintendent of Documents.

THE FUTURE DEVELOPMENT OF THE SHANGHAI HARBOUR: Report to the Whangpoo Conservancy Board—By Vattenbyggnads Bryan, Represented by Dr. J. G. Richert, C. W., and P. G. Hornell, C. E., and H. von Heidenstam, C. E. Shanghai, China: The Board. Paper; 9 x 12 in.; pp. 54; illustrated.

Prospectus of a most ambitious scheme to dam the mouth of a river and create a tidal lock and wet dock for a harbor, extending miles back from the lock. Scheme described in *Engineering News-Record*, Nov. 21, 1918, p. 935.

THE HEATING OF HOUSES: Coal and Electricity Compared: Report Feb. 28, 1918, Hydro-Electric Power Commission of Ontario. Toronto, Ont.: The Commission. Paper; 7 x 10 in.; pp. 12.

HOW INDUSTRIAL FATIGUE MAY BE REDUCED: Preliminary Report of Divisional Committee on Industrial Fatigue, Section on Sanitation, National Committee on Welfare Work. Washington, D. C.: U. S. Public Health Service. Paper; 6 x 9 in.; pp. 12.

HYDRAULIC EXPERIMENTS WITH VALVES, ORIFICES, HOSE, NOZZLES, AND ORIFICE BUCKETS: Part I—Loss of Hydraulic Head in Small Valves, by Arthur N. Talbot, Professor of Municipal and Sanitary Engineering in Charge of Theoretical and Applied Mechanics, and Fred B. Seely, Assistant Professor of Theoretical and Applied Mechanics; Part II—The Flow of Water Through Submerged Orifices, by Fred B. Seely; Part III—Fire Streams from Small Hose and Nozzles, by Virgil R. Fleming, Assistant Professor of Applied Mechanics; Part IV—The Orifice Bucket for Measuring Water, by Melvin L. Enger, Associate Professor of Mechanics and Hydraulics. Urbana, Ill.: Engineering Experiment Station. Paper; 6 x 9 in.; pp. 80; illustrated.

While they last, these concise summaries of experimental work at the Hydraulic Laboratory of the University of Illinois may be obtained by interested engineers without charge.

ILLINOIS SOCIETY OF ENGINEERS: Proceedings Held at Quincy, Ill., Jan. 24-25, 1918—Wheaton, Ill.: E. E. R. Tratman, Sec. Paper. 6 x 9 in.; pp. 148; illustrated. 50c

IOWA ENGINEERING SOCIETY: Proceedings Held at Waterloo, Iowa, Feb. 20-21, 1918—Iowa City, Iowa: J. H. Dunlap, Sec.-Treas. Paper; 6 x 9 in.; pp. 148; illustrated. 50c.

A NEW THEORY OF THE STEAM TURBINE—By Harold Medway Martin, Wh. Sc., A. C. G. I. Reprinted from *Engineering*, London, England. Paper; 8 x 11 in.; pp. 22; illustrated. 2s. 6d.

OHIO ENGINEERING SOCIETY: Proceedings Held Jan. 30-31, Feb. 1, 1918—Norwalk, Ohio: John Laylin, Sec.-Treas. Paper; 6 x 9 in.; pp. 174; illustrated.

POWER: Its Significance and Needs—By Chester G. Gilbert and Joseph E. Pogue, of the Division of Mineral Technology, U. S. National Museum. Washington, D. C.: Smithsonian Institution. Paper; 6 x 9 in.; pp. 53; illustrated.

Proposes a common-carrier system of transmission for electric current, whether generated by water power or from coal.

THE PUBLIC WORKS DEPARTMENT, MADRAS PRESIDENCY; ADMINISTRATION REPORT FOR 1916-17—Part II, Irrigation—Madras, India: Public Works Department. Paper; 9 x 12 in.; pp. 206; illustrated. 3s. 9d.

QUEBEC STREAMS COMMISSION SIXTH REPORT: Printed by the Order of the Legislature—Quebec, Can.: The Commission. Paper; 7 x 10 in.; pp. 140; illustrated.

THE RATE OF COAL CONSUMPTION IN VARIOUS ELECTRIC GENERATING STATIONS AND INDUSTRIAL ESTABLISHMENTS IN CANADA AND THE UNITED STATES: Report, Feb. 15, 1918, Hydro-Electric Power Commission of Ontario—Toronto, Ont.: The Commission. Paper; 7 x 10 in.; pp. 12; illustrated.

ROCK QUARRYING FOR CEMENT MANUFACTURE—By Oliver Bowles. Washington, D. C.: Bureau of Mines. Paper; 6 x 9 in.; pp. 152; illustrated. 25c. from Superintendent of Documents.

THE SAFETY MOVEMENT IN THE IRON AND STEEL INDUSTRY, 1907-1917—By Lucian W. Chaney and Hugh S. Hanna. Washington, D. C.: Bureau of Labor Statistics. Paper 6 x 9 in.; pp. 289; illustrated.

SOME TESTS OF DOUGLAS FIR AFTER LONG USE—By Arthur C. Alvarez; Bulletin of the Department of Civil Engineering, University of California. Berkeley, Cal.: The University. Paper; 7 x 10 in.; pp. 119; illustrated.

Beam, compression, shearing and impact of 10 x 12-in. to 6 x 8-in. Douglas fir timbers taken from old city hall of Oakland, Cal., after having been in use 36 years.

TERRACING FARM LANDS—By C. E. Ramser, Senior Drainage Engineer. Washington, D. C.: Bureau of Public Roads. United States Department of Agriculture. Paper; 6 x 9 in.; pp. 39; illustrated.

UNIFIED MATHEMATICS—By Louis C. Karpinski, Ph. D., Associate Professor of Mathematics, University of Michigan; Harry Y. Benedict, Ph. D., Professor of Applied Mathematics, University of Texas, and John W. Calhoun, M. A., Associate Professor of Pure Mathematics, University of Texas. New York: D. C. Heath & Co. Cloth; 5 x 8 in.; pp. 518; illustrated. $2.80.

SOCIETY SERVICE

A Section Dealing with the Results of Teamwork by Technical Men

Advise Continuance of Chicago Technical Societies' War Committee

Closer association of 19 technical societies in Chicago through a war committee has been found of sufficient value for that body to recommend the continuance of the committee in its present form. At a meeting held Dec. 6 it was suggested that matters on which the combined influence might be made effective for the betterment of the community and profession would include the employment question, legislative action on licensing, the technical man's place in the constitutional convention soon to be held in Illinois, and the proper steps to be taken to insure that the state budget, now being made up, contain provision for the supervision of the expenditure of the $60,000,000 good-roads bond issue. It is proposed to coöperate with the employment activities which the secretaries of the four founder societies in New York have taken over from the Engineering Council.

The report of the services rendered by the war committee during its brief existence since June, as given by the secretary, E. S. Nethercut, includes the following: Two general meetings on war subjects were held to which the 5000 individuals of the member societies were invited. A group meeting of eight societies brought out more than 200 to hear a discussion on light and fuel problems. Governmental requests for technical men were complied with, from 50 to 75 men being placed directly.

One of the larger works was the giving of information by the committee to men seeking to put themselves in touch with the service where their talents could be utilized to the best advantage. Through the committee's efforts $30,000 was collected for the third Liberty Loan and $90,000 for the fourth.

Minnesota Engineers Propose Inclusive State Technical Society

Affiliation of technical societies for joint action during the war seemed the natural thing. Minnesota had previously its Joint Engineering Board, with six organizations represented. As the necessity for giving broader powers to this board is now felt, a tentative plan has been presented to all of the societies in the state to come into an all-inclusive organization of still wider scope, to be called the Minnesota Polytechnic. It would act in all state-wide and inter-society matters, have an official publication and a paid secretary who would send out notices for all societies, and handle all inter-society and all committee work.

Any member of an affiliated society would be a member of the Polytechnic, but to gain membership he must do so through a local society. The board of directors, one representative for each affiliated society, would meet monthly, and there would be an annual convention, at which delegates of uniform representation from the affiliated societies would transact business. Funds would come from the affiliated societies.

Four societies, or chapters of national societies, in addition to the six now affiliated, are eligible. Expansion of the powers of the state organization would include making them definite, providing for engineers who are not now members of local societies and for such chapters as would serve drainage engineers, municipal engineers and surveyors.

The proponents of the new society write in the November *Bulletin* as follows: "In approaching this question, the fact must not be lost sight of that there will be, and probably very soon, a great national united engineering society, taking in all branches of the profession. Any state organization should be so planned that it may become a part of and responsible to this national organization in technical matters, retaining full power of self in state and local affairs."

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Five-Ton Capacity Truck Should be The Heaviest Allowed

Sir—I read with considerable interest and pleasure, in your issue of Nov. 28, the article, "Highway—Motor Truck Problem from the Standpoint of the User, Manufacturer and Engineer."

I have been combatting for the past four years the idea of using more than a five-ton load on our improved highways, or the highways we may make in the future. This, of course, excepts special roads where Government aid might be applied for a specific purpose.

Before I became a member of the West Virginia State Road Commission, nearly two years ago, I was a truck user myself, having been a road contractor for a number of years, on a fairly large scale. For excavation haulage, as a rule, I did not find the truck profitable, but for hauling all kinds of material I used it largely.

But, coming to the load, I have not opposed five tons (not very vigorously at any rate), but I want to state, for what it may be worth, that I have gotten better results by the use of a three-ton truck. It is true, where I had a three- to ten-mile haul, I used a trailer, hauling brick, sand, cement and gravel, and got better results than I ever got by using a heavy five-ton and surely better than I could by using more than a five-ton load. This was because the three-ton truck made very much better time. It was also not out of commission so much through breaking down, etc., and I did not have to keep as many men on the road to take care of the maintenance. My observation has been, since I quit being a user—and I visit all the counties in the state where road construction is going on—that probably the three-ton truck still gives the best results. However, as stated, I do not oppose vigorously a five-ton-load truck, and I am very much pleased to have my views in this matter

backed up as strongly as they are in the article above mentioned.

I wish to back up the statement that the truck has come to stay. There is no question in my mind about that, but I want to tell the people that they must not deceive themselves about truck haulage for long hauls and heavy freight. Thirty-five to 50 miles is going to be the limit from a standpoint of economy, and that only for certain classes of freight, not the heaviest.

The amount of stuff hauled for the past three or four years, as every one knows, has been abnormal. The question of expense did not figure. It was only a question of getting the goods at any price. The railroads were caught by this abnormal demand for the transportation of merchandise and materials of all kinds when they were in the worst condition they had ever been in. I am a believer in railroad regulations, but our roads had been regulated until one-half or more of them were in the hands of receivers. The roadbeds and the rolling stock had run down. In my opinion, they were not getting money enough to run their business on a business basis. Too much regulation! As a heavy shipper, had I been charged 15% more freight, I feel that I would have made from 15 to 20% more money, because I could have demanded service, and service is what we need in the matter of transportation. Moreover, the roads could and no doubt would have given me better service without any very strong effort on my part. Now the railroads are going to come again, for we are going to give them money enough to run their business right, and they are not only going to do the heavy hauling, but, from an economical standpoint, must do the long hauling.

I say, then, that while the truck has come to stay it is not for long hauls or extra-heavy hauls, and the public is not going to build and maintain roads to carry loads, including vehicles, of 12, 15 and 20 tons.

If you give me the right kind of an engineer and inspection, I will build a road, out of any of the standard materials mentioned by "Engineer" in your publication above referred to, that will take care of three- to five-ton-load trucks with the recognized amount of maintenance and give long service, but I want nothing heavier than five tons and prefer a three-ton load as the maximum.

I want to say that the motor trucks and the motor passenger vehicles and the construction that will take care of a two-ton truck and less are going to be the class of transportation that will help the country most at the present time. We must take care of these and not allow Mr. Heavyload to put them out of business by destroying the road. Heavy-load at best is going to be handled by but a small percentage of the people who will be taxed to build and maintain the road.

T. S. SCANLON,
Secretary and Treasurer, West Virginia State Road Commission.
Charleston, W. Va.

Railroad Versus Motor Transportation

Sir—Articles and letters appearing in your magazine on motor-truck and railway transportation lead me to contribute the following:

Whitefish, Mont. (population 3000) and Kalispell, Mont. (population 5500), are distant from each other 17 miles by highway and 24 miles by railway. Deep snows through January and February practically prohibit the use of motor trucks or autos during those months. Kalispell is a wholesale center, and practically all groceries, hardware, gasoline, etc., used in Whitefish must come from there. Kalispell is a county seat, and there is much passenger travel between the two places.

For 10 months in the year the truck company and the two passenger auto companies carry 95% of the freight and passengers. The freight and passenger rates by auto are the same as by rail, the autos having the best of it by seven miles in distance.

During January and February 95% of the traffic, freight and passenger, is by rail, as the autos quit when the snow gets deep.

The railroad must pay for the cost of "readiness to serve," or has a fixed operating cost. Its rates are based on this cost, divided into twelve months. Having business only two months in the year, it must lose money. If the railroad had the business 12 months in the year, it would still lose money in January and February, in all probability, owing to weather conditions.

I conclude as follows: If the motor trucks and passenger autos take the cream and leave the skim milk for the railways, the motor-truck business will be fine for the trucks, but will rob the railways of money they need for fixed operating expenses.

W. K. TRIPPET.
Whitefish, Mont.

Correcting a Possible Misinterpretation

Sir—I wrote an article for the Nov. 28 issue of your paper, entitled "Limitations To Be Placed on Trucks, From User's Viewpoint," and, owing to my duties in Washington, I did not have an opportunity to read the proof you submitted before the paper went to press. In fact, my time was so limited that I was unable to go over it to correct grammatical errors, and suggested to your editorial department that such corrections be made for me by your own staff.

Unfortunately, however, the intent of the second paragraph, in the second column, appearing on p. 968, was misinterpreted, and if printed as I originally wrote it, it would have read as follows:

"It is thought that perhaps the first converts to the belief in the utility and desirablity of passenger cars, aside from those owning them, were the officials of the state highways departments, and quite logically so because, although when they realized that owing to the use of passenger cars the road surfaces were subject to considerably more wear, they rapidly appreciated that the use of these vehicles would serve to stimulate the interest of the general public in their work, which would mean that they would get greatly increased support in their road-building plans."

Inasmuch as the paragraph referred to, as it was printed in your issue of Nov. 28, might be misinterpreted by your readers as casting aspersions on the public-spiritedness of the highway engineering industry, I am exceedingly anxious that this letter be printed to make it perfectly plain that there was no such intent in my mind when the article was written.

GEORGE H. PRIDE,
President Heavy Haulage Company.
New York.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Jackhamers, Jacks and a Steam Shovel Make Cut in Old Pavement

A TRENCH for a new street railway track in Chicago was recently cut through an 8-in. concrete base at the rate of about 200 ft. per day. The plant and force employed consisted of a portable drilling outfit, a revolving steam shovel, and two gangs of jack and bar men. The cut was 20 ft. wide along the center of the street, and was made after the wood-block paving had been removed.

A portable air compressor, operating four jackhamer drills, led in the work. Holes about 6 in. apart and 1 in. in diameter were drilled through the base. First, a row of holes was drilled on each side of the cut; then, transverse rows, 6 or 7 ft. apart were put through the strip to be removed. Two gangs of bar and jack men followed the drillers, breaking up alternate 75 to 100 ft. sections of the slab. Each gang broke out the concrete in transverse sections, corresponding in width to the space between the transverse rows of drill holes, and threw the fragments behind.

By use of two or three ratchet jacks with a hold under the edge, the base slab was lifted until it cracked into pieces of one or two square yards, with smaller pieces. Men with bars pried the slabs apart, and others using heavy two-handed sledges broke the larger pieces into sizes which would pass a ½-cu.yd. steam-shovel dipper. Pieces which failed to break from the edges of the cut were wedged free with steel points sledged into the drill holes. The steam shovel followed the rearmost breaking gang and loaded the broken concrete into dump wagons for disposal. The work was done for the Chicago surface lines.

Combination Platform Saves Time for Motor Trucks at Terminal

MOTOR trucks which were used in the aircraft spruce production program in the Northwest were unloaded at terminals by the use of inclined platforms. These platforms were built so that the wheels on the side away from the bank of the stream would run up onto a higher level, leaving the wheels on the river side at grade. Thus, the bed of the truck tilted toward the skids down which the log was expected to roll, and it was only necessary to release it from the truck bed. When large logs were being hauled they were not chained in place, their weight being expected to hold them. Metal chocks on the cross-beams, appearing in silhouette in the picture, served to prevent the load from slipping off in transit.

The picture shows a large 6-ft. log just rolling off after the chocks on the river side were removed. At the extreme right is shown the reloading platform used for putting the trailer on the truck body. On some of the hauls the trailer was always loaded for the return trip, to increase the traction. When this was done the truck could climb the extremely steep grades (up to 19%) without chains, which were expensive in terms of time, tires and roadway planking. To load

TILTED PLATFORM TIPPING 6-FOOT LOG FROM TRUCK

a trailer it was backed up onto the platform over a pair of runways, one for each wheel. These runways were built up so as to be convenient for one man to handle. The truck then moved forward, the runways were removed, and when the truck backed up against the platform the trailer was run onto the body and chained.

The photograph was supplied by G. W. Gauntlett, district superintendent for the Warren Spruce Co., at Raymond, Wash.

Old Rails Make Hanging Ways for Pile Hammer

BY JOHN H. SAWKINS
Schenectady, N. Y.

HANGING ways for a pile hammer designed to be used in connection with a locomotive crane were recently constructed, at small cost, of old rails and steel plates. The ways cost $250, including labor and material. Henry Steers, Inc., contracting engineers, New York, were the builders.

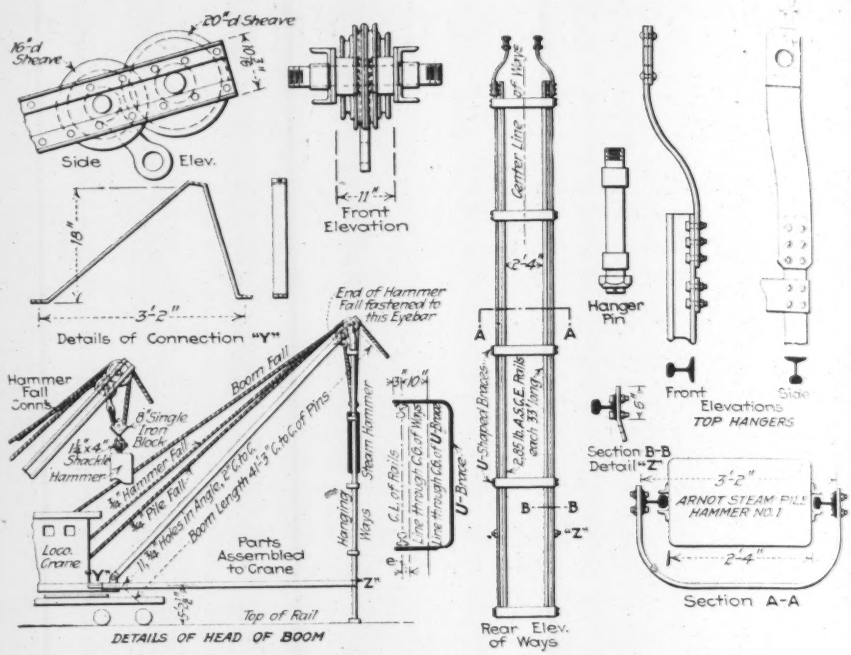
Three features of the design and construction are the eccentricity of the pin holes in the top hangers; the link connections at the boom end for the hammer fall and the single block, and the adjustable horizontal braces connecting the bottom of the ways with the locomotive crane.

Eccentricity of pin holes was provided so that the ways would hang plumb from the tip of the boom. The eccentricity was calculated as follows: The center of gravity of one of the U-braces was found, by balancing it on knife edges, to lie 10 in. back of the center line of the rails, as shown by the sketch. Two 85-lb., 33-ft. rails weighed 1870 lb., and five plates, each ¾ in. x 6 in. x 5½ ft., weighed 424 lb. Taking moments, $1870e =$

424 × (10 — e). Then e = eccentricity = 1.85 in., or, say, 2 in. This calculation neglects the two ½ x 7-in. hanger plates; these, however, are practically balanced.

The plumb position of the ways coupled, with the connection of the hammer fall, eliminates any horizontal thrust on the rail guides as the hammer rises and falls. Such a thrust, besides causing stress and vibration, tends to make the ways pick out at the bottom. Notice, from the drawing, that the vertical axis of the single block will coincide very nearly with a vertical line through the center of gravity of the ways, for any position of the hammer.

Adjustable horizontal braces permit raising or lowering the boom, to alter the height of the ways. As the boom height is altered, the distance between Z and Y changes. This change is met by shifting the connecting bolt back or ahead in the series of holes at the Y end of the braces.



HANGING WAYS FOR LOCOMOTIVE CRANE PILE HAMMER BUILT OF OLD RAILS

Dump-Car Train and Spreader Backfill Sewer Trench

TRENCH for a 16-ft. concrete sewer in Chicago was backfilled recently by a dump-car train hauling a standard spreader. Standard-gage track for backfilling ran along the edge of the trench, which was from 40 to 45 ft. wide on top and 30 ft. deep, and was excavated in two lifts. The first cut, about 10 ft. deep, was made by a steam shovel loading to dump-car trains which wasted the spoil; the cut had sloping sides and, as indicated by the figures just given, was very wide at the top. The second cut was made by a dragline excavator working on the floor of the cut made by the steam shovel, and digging a trench about 22 ft. wide, with nearly vertical sides.

The spoil from the second cut, a heavy clay, was used for backfilling. It was loaded by the dragline excavator into trains of 6-cu.yd. side-dump cars, with a standard-gage spreader car at the rear. As the cars were dumped the train was hauled ahead, and the spreader scraped the dumped spoil sidewise into the trench, as shown by the illustration. No hand spreading or handling of the backfilling other than as described was necessary. The T. J. Florschner Contracting Co., Chicago, was the contractor.

SEWER BACKFILLING PLACED BY DUMP-CAR TRAIN WITH SPREADER CAR

Divert Rivers to Protect Harbors

To prevent silting in the adjacent harbors of Los Angeles and Long Beach, Cal., by floods from the Los Angeles River and the San Gabriel River, it is proposed to cut a new channel 650 ft. wide to discharge both rivers into the ocean east of Long Beach harbor. The estimated cost is $1,000,000. For this there is available a Federal appropriation of $500,000 and a state appropriation of $250,000 while the state has promised to equal the Federal appropriation. Los Angeles County has appropriated $800,000 for right-of-way, and the Secretary of War is to institute condemnation proceedings for the required land

NEWS OF THE WEEK

New York, December 19, 1918

Engineers Urge Policies for Public Works

National Department Favored, Also Placing of Civil Engineers on Waterways Board

Appropriation of $1,000,000,000 for public works of drainage, irrigation and flood protection was urged in a resolution adopted by the National Drainage Congress at its meeting in Chicago, Dec. 13-14. It also petitioned President Wilson to appoint the waterways commission of seven members authorized by the act of Aug. 12, 1917, and, while the law requires an Army engineer at the head of the commission, the petition suggested the appointment of not less than three civil engineers as members, "in recognition of the services rendered to the United States Government in its time of need by a great body of civilian engineers."

Ask for National Department

Creation of a national department of public works, with its executive head a member of the President's cabinet, was another recommendation. Prosecution of the following projects was advocated: the Atlantic coast waterway; the Lake Erie and Ohio River Canal; the Ohio River improvement; storage reservoirs on the Alleghany, Monongahela and other rivers, as means of flood control and aids to navigation; the Lake and Gulf waterway from Chicago; and the improvement of the Upper Mississippi, the Missouri and the Columbia Rivers.

Federal aid for drainage of swamp and overflow lands, similar to that already extended for irrigation, was urged. As local projects of this class have been devised usually with little regard to general plans covering the valleys in which they are located, the Governors of the states are asked to consider the desirability of unifying state agencies responsible for water resources, and the desirability of advocating the passage of state acts to revise the drainage laws. Related to this was a resolution authorizing the president of the drainage congress to appoint a committee to report some plan of stabilizing the value of drainage bonds and other securities for improvement works.

Diversion of flood waters and their subterranean storage for the benefit of the semi-arid lands was also advocated, with the recommendation that Congress provide necessary funds.

Plans were favored for providing good agricultural lands for soldiers and sailors returning to civil life, such lands to be sold at cost and upon favor-

(Concluded on page 1146)

Representative Highway Congress in Chicago Unit for National System

Interstate Motor-Truck Transportation Here To Stay—Enlarged Federal-Aid Appropriations Approved

Federal highways and a Federal highway commission to build and control them—this, and motor-truck regulation, were the problems threshed out most energetically at the joint highway congress at Chicago, Dec. 9-13, under the auspices of the American Association of State Highway Officials and the Highway Industries Association. Nearly 1500 highway officials, engineers, contractors, material and equipment men, and good-roads enthusiasts registered.

Discussion waxed strongest on the question of proposed Federal legislation, which states rights adherents strongly apprehensive of any bill which might curtail or restrict the powers of state officials.

The Association of Highway Officials, in separate session, indorsed the Page bill, which would amend the present Federal-aid act by increasing the appropriations by $50,000,000, available on passage, $75,000,000, on July 1, 1919, and $100,000,000 per year for three years. It would also eliminate some of the post-road limitations and permit payment of half of the cost of accepted roads, with no limit as to total cost. On the question of a Federal highway commission and a national system the two organizations were somewhat at variance, the joint congress asking for legislation immediately and the highway officials passing the following resolution:

Resolution of State Highway Officials

"Resolved, that the executive committee is requested not to submit any further legislation than the Page bill [noted above] to the present short session of Congress; that the executive committee formulate and submit to the various state departments, as soon as may be, a separate bill providing for a Federal body or officer with adequate power and funds to administer all Federal and Federal-aid highway laws, which are now, or may hereafter be, in effect. It is the sense of this meeting that the law should be so drawn as to take the fullest possible advantage of the experience and personnel of the present Federal administrative body, the effectiveness of which is hampered by the present limitation on salaries, and the present too great centralization of the administrative functions, especially as concerns construction matters.

"We favor an adequate Federal highway system upon which the Federal-aid funds may be concentrated. The Federal system should be selected by the various states and connected at the state lines by the Federal department in cases where connections are not made by adjoining states. Nothing in any Federal enactment should prevent any state from gaining all the Federal aid accruing to it, nor deprive any state of the full administrative and legal control of all highways within its borders, and of the location of the improvements on the Federal highway system."

The highway officials asked for the immediate release of highway engineers now in Government service and for an investigation in conjunction with the Highway Industries Association of motor-truck regulations and limitations, with a recommendation to be based on such an investigation. Not only are existing data to be examined, but experiments on different types of pavement are called for, to be carried out by various states. Another resolution provided for the development of a comprehensive plan of experiments on which a recommendation can be made for a uniform traffic law for the different types of pavements. The officials also called upon the War Industries Board to remove all restrictions on the use of reinforcing and structural steel for highway bridge purposes, and instructed the executive committee of their association to urge upon the Capital Issues Committee the release of control of highway bond issues.

The newly elected officers of the highway officials are as follows: A. R. Hirst, president; Paul D. Sargent, vice president; A. D. Williams to continue as acting secretary in the absence of Col. Joseph Hyde Pratt on overseas duty, and W. S. Keller, treasurer.

Governor Lowden Starts Joint Sessions

Economics and ultimate service were the burden of Gov. Frank O. Lowden's address in opening the joint sessions and welcoming the delegates to Illinois, where a $60,000,000 bond issue has recently been voted. "Keep the good-roads idea sold like good salesmen," was his advice to those who would stop the good-roads propaganda. That ap-

pointing officials must keep out incompetents, that engineers must recognize their heavy responsibility to build the roads as economically as private companies would, that material men must be satisfied with a fair profit (for upon this factor largely depends the beginning of the building in Illinois)—these were sentiments upon which the Governor elaborated.

James I. Blakslee, fourth assistant postmaster general, presented a vigorous argument for good roads by which the mounting high cost of living may be reduced. Motor postal routes will aid materially, in his estimation. He said: "The establishment of vehicle truck routes would eliminate wasted food which cannot get to market, employ labor in essential occupations, utilize a modern mechanical device, encourage the construction and improvement of highways, let the producer produce, the consumer consume and the conveyor convey."

Mr. Blakslee's suggestions for three different methods of meeting the cost of construction and improvement of highways are as follows: First, for a highway entirely Federal or national in character—for which the Federal Government should defray the cost of construction, improvement and maintenance—an interstate highway available not only for the transportation of merchandise and food products, but also useful for military purposes. He proposes a system of 15,000 miles, costing about $30,000 per mile, which could be paid for in a reasonable time from the earnings of the service performed upon it. Second, for a highway supported by the Federal Government and the state local subdivision. Third, for a highway, supported by the state, county or township, which would include the construction and maintenance of dirt, gravel or sand clay roads which should be paid for solely by the local state, county or township, and would be utilized as feeder roads and finally connect with the national trunk roads.

National Highway Transport Here

Roy D. Chapin, who was, until his resignation last week, chairman of the Highway Transport Committee, said, in speaking of "The Present and Future of Highway Transport in America":

"A year ago highways transport had arrived nationally, though few of us knew it. Today it is known, discussed, praised, criticised, encouraged, and every month sees it grow in volume by leaps and bounds. The war pointed out that our highways could greatly supplement all other forms of transportation, and who can tell just how much our share in the war was speeded up by highways transport, not only here but in France?

"Today it is our duty to develop broadly this mighty, new form of transportation, properly coördinate it with others, safely guide it through these early stages of growth and make it responsible for opening up every nook and corner of our land.

"There must be regulation of highways transport. Its full development is dependent, partly, on the elimination of irresponsible operators, the stabilizing of rates, the working out of uniform bills of lading, and methods of insuring loads. Analysis must be made of the desirability of exclusive franchises to operate over certain highways. It is the present thought of our committee that such franchises are not conducive to the best interests of the people. Provided rates for traffic are properly stabilized, competition over the highways would seem far better for the shippers, and only in this way will rates finally come down."

As to what the Government should do, in this period of readjustment, toward the development of highways and highways transport, Mr. Chapin believes there should be in Washington a comprehensive organization, not only for the administration of Federal road funds, but also for the exhaustive study of the possible growth of highways traffic during the next decade, from which resultant recommendations should be made to all the highway authorities of the country as to the type of roads that should be built to handle this traffic successfully.

"A Suggested National Highway Policy and Plan," the subject of a paper by E. J. Mehren, editor of *Engineering News-Record*, printed on page 1112, carried the conviction home, without much argument left, that the time is ripe for a national system, Federally administered. At any rate, practically no opposition was offered at a succeeding session, when resolutions adopting this platform for a 50,000-mile system,

(Concluded on page 1149)

What Next in Engineering Education?

The demobilization of the S. A. T. C. in the engineering colleges, and the rapid transition to peace conditions, are being recognized as the greatest opportunity ever presented to introduce changes in engineering education long debated but prevented by inertia or fixed academic traditions. Engineering educators, as was evidenced at the recent meeting of the S. P. E. E. at Boston, are actively engaged in the work of revising pre-war courses to meet new demands. They need the coöperation and help of practicing engineers. "Engineering News-Record" urges all to give thought to this vital subject and send in their ideas for publication. They can thus aid in preparing the specifications for the desirable engineering graduate, as suggested by Dr. Mann in his address at Boston (see p. 1068 of last week's issue). Practicing engineers must help the teachers, and we welcome all communications on this timely subject.

Highway Industries Association Holds Annual Meeting

Following the joint Highway Congress at Chicago last week, the Highway Industries Association held its annual meeting. Besides the disposal of routine and administrative matters, the meeting indorsed the resolution of the Highway Congress in favor of increased Federal-aid funds, a national highway commission and a national highway system, and authorized the president of the association to appoint a finance committee and a membership and organization committee.

In conformity with the constitutional provision that additional directorships be established for each 50 members in the organization, the president declared a new directorship created, the association now having 67 members. David S. Ludlum, president of the Autocar Co., was elected to this directorship.

The directors reëlected were W. P. Blair, representing the National Paving Brick Manufacturers' Association; A. T. Rhodes, representing the Granite Paving Block Manufacturers' Association; E. J. Morrison, representing the National Association of Asphalt Block Manufacturers; W. T. White, representing the National Automobile Chamber of Commerce.

The following officers were elected: President, S. M. Williams, sales manager of the Garford Motor Truck Co.; first vice-president, G. P. Coleman, state highway engineer of Virginia; second vice-president, E. J. Mehren, editor of *Engineering News-Record*; third vice-president, Charles J. Lang, president of the Lakewood Engineering Company.

Engineers Urge Public Works

(Concluded from page 1145)

able terms. The resolution proposed, to further this development, the formation of a bureau of agricultural colonization and training in the United States Department of Agriculture; this to be supplemented by national, state and local training schools and farm associations.

Highway development was indorsed, and alliance with the National Highway Association was proposed. Edmund T. Perkins, Chicago, was elected president of the National Drainage Congress.

Shipyards May Now Accept Private and Foreign Orders

The United States Shipping Board announced during the past week that American shipbuilders may accept contracts to build wood ships for either foreign or domestic account, without special authorization from the board. Similar permission was granted to companies building steel ships so far as domestic orders are concerned, but the former prohibitions stand with respect to orders of foreign owners.

Cancellations of many contracts for wood ships were announced Dec. 13, supplementing previous cancellations.

The precise number of ship contracts that will be affected is not yet known, as it will depend on the money spent on the particular ship. Work is to be discontinued on every ship on which not more than $200,000 has been spent. The cancellations, however, may for the present be regarded as suspensions, since their disposition will depend upon the success of Chairman Hurley's efforts to sell wooden ships in Europe.

Orders for wooden ships totaled 731, of which number, 367 ships have been launched, 193 are under construction, and 171 keels are still to be laid.

Federal Aid Refused to Hudson Tunnel

After a long hearing, the Senate Committee on Interstate Commerce has voted against a favorable report on the Calder bill which authorized the Federal Government to appropriate $6,000,000 to join the states of New Jersey and New York in building a highway tunnel under the Hudson River at New York City. In all probability, this means a rejection of the similar Eagan bill in the House of Representatives.

McAdoo for Extending Federal Control Five Years

Extension of Government control of the railways for five years, or until Jan. 1, 1924, is urged in a recent letter from Director General of Railroads McAdoo addressed to Senator E. D. Smith, chairman of the Senate Committee on Interstate Commerce, and Representative Thetus W. Sims, chairman of the House Committee on Interstate and Foreign Commerce. Mr. McAdoo maintains that it would be impossible to obtain legislation during the present session of Congress providing a permanent solution of the railroad problem, and that it would be impracticable and opposed to public interest to attempt private operation of the roads under the present laws.

In speaking of the carrying out of necessary improvements in the national railway system, Director General McAdoo says: "The period of two years is entirely too short a time within which to plan and carry out the comprehensive improvements which ought to be made to meet the country's requirements under peace conditions. Many of the improvements could hardly be completed and put into operation inside of the two-year period and under such circumstances and facing a change to private management at the end of two years it would be unwise in the highest degree to make the improvements and impossible to secure the hearty coöperation of the railroad corporations."

The alleged inadequacy of present legislation with respect to the division of authority over railroad corporations between state and Federal commissions was emphasized as an important argument against the return of the roads to private control in the near future.

Public Health Requires Engineering Service

Convention Considers Medical, Technical and Administrative Problems of Sanitation and Industrial Housing

Engineering in relation to public health was represented only fairly well at the largely attended 46th annual meeting of the American Public Health Association held in Chicago Dec. 9-12. While the greatest interest in the general meetings centered on discussion of the various phases of the influenza epidemic, engineers were more particularly served by the section on sanitary engineering, which held two sessions. The attendance and the discussions at these sessions, however, were limited. Some papers related to bacteriological work were included in the program of the laboratory section. In addition to six general sessions of the association, there were about 25 sessions, held by the seven sections into which the convention was divided.

Municipal and Shipyard Sanitation

Chlorination of the water-supply of Chicago was described by John Ericson, city engineer, and in the discussion it was pointed out that one element of the success of this treatment is variation of the dosage in accordance with wind and weather conditions on the lake, as these conditions are found to influence directly the bacterial content of the water. While Chicago already has the remarkably low typhoid death rate of 1.7 per 100,000, it is expected that the figure for 1918 will be below 1.5.

Conditions at Milwaukee in regard to quality of the lake water were described by T. Chalkley Hatton. Treatment of Chicago sewage by dilution in the Drainage Canal was indorsed by C. D. Hill, engineer of the Board of Local Improvements, and Langdon Pearse outlined the experiments on preliminary treatment of sewage before its discharge into the channel.

Sanitary work at the shipbuilding yards was reviewed in a paper by Lieut.-Col. Philip S. Doane, director of health and sanitation for the United States Shipping Board. In the 11 yards operated by the board it was not difficult to carry out sanitary measures, but the other 160 yards work under contracts, none of which calls for specific sanitary equipment, and only a few of which provide for maintenance of sanitary and hygienic conditions. Thus, the health department had to work diplomatically and in an advisory capacity, but in most cases the yards carried out the suggestions made. Interconnection of dual water systems for fire protection and drinking supply, with only a single gate valve for the protection of the latter, was a common trouble that has been almost entirely eliminated. Water-supply, sewage disposal, food protection, toilets, fly and mosquito conditions were the principal centers of activity. Closely related to this subject was the mosquito control at Hog Island, described by B. F. Royer, acting state commissioner of health for Pennsylvania.

Housing Shipyard Workers

Housing work of the United States Shipping Board was described by Morris Knowles, chief engineer of the housing department of the board, who showed plans of various layouts and also photographs illustrating the types of structures employed. In the discussion the great extent and importance of the housing work carried on by different departments of the United States Government were mentioned by C. B. Ball, chief sanitary inspector, Chicago. It is being recognized that a house must be something more than a shelter; it must provide for health, comfort and convenience and for the maintenance of family life and conditions. A serious problem at present is the future of this Government work. Mr. Ball urged that it should not be stopped because the war has stopped, but should be carried to completion and supplemented by plans for the operation and maintenance of the new industrial towns and villages.

Recovery of grease and tankage from garbage has fallen off slightly under war conditions, in spite of the educational work of the Food Administration. This was shown in a report presented by Samuel A. Greeley, Chicago. Prices have increased from about 5c. to 15c. per pound for grease and from $7 to $18 per ton for tankage.

"A Critical Study of the Bacterial Count in Water and Sewage," dealing with the probabilities of errors, was presented by Milton F. Stein, designing engineer, Division of Sanitary Engineering, Cleveland. The paper, which draws conclusions of value to sanitary engineers as well as bacteriologists, is printed in the *American Journal of Public Health*, November, 1918.

Education in Sanitary Matters

General education in sanitary matters as a means of preventing disease and promoting both public health and physical fitness was the keynote of the presidential address by Dr. Charles J. Hastings, Toronto. The necessity for this is shown by the fact that from 50 to 75% of our volunteers, drafted men and conscripts for the recent war, were found physically unfit for military service. This unfitness was due mainly to preventable and curable diseases and physical defects. Public recognition of the health officer was discussed by Dr. Lee K. Frankel, New York. He presented statistics showing that of 417 cities, 153 had full-time officers and 264 part-time officers, most of the former being in cities under 50,000. In the majority of cases no training in taking care of the public health is required of candidates for office.

Universal Membership
The Goal of the Red Cross Christmas Roll Call

The aim and underlying purpose of this campaign is to recruit under the banner of the Red Cross every loyal American no matter where he or she may live. "A large membership in the Red Cross means more 'Over There' than money," said Chairman Henry P. Davison upon his return from a visit to every battle front. It is hoped and expected that this great ambition will be realized. It can be if every patriotic man and woman makes it their responsibility to get universal membership in the Red Cross.

The object of the Red Cross Christmas Roll Call is to register in terms of active participation the spirit of a nation. The spirit in question is personified in Red Cross membership. Everyone is urged to make it unanimous.

Chicago Highway Congress

(Concluded from page 1146)

serving 90% of the people at a cost of $1,250,000,000, were submitted.

A. R. Hirst's paper on "The Underlying Principles Controlling the Laying Out, Marking and Maintaining of a State Highway System," was a most valuable paper with deductions from pioneer experiences which no highway engineer should miss. (See *Engineering News-Record* of Dec. 12, p. 1065; also p. 1128 of this issue.)

Motor-Truck Regulation

Motor trucks must be regulated and the truck makers and users are as keen for doing it as the road men. George M. Graham, chairman of the Motor-Truck Committee of the National Automobile Chamber of Commerce, presented the truck side of the case most forcibly, as set forth on p. 1109. His thesis was based on the proposition that the highways should be the servant of transportation, not its master. Against his proposed truck regulation law for a 14-ton limit, 800-lb. per inch width of tire, respective speeds of 30, 20 and 15 miles per hour over country, suburban and city pavements, were arguments by several engineers indicating that the values were too high.

A. D. Williams, chairman of the State Road Commission of West Virginia, combining his own remarks with a written discussion sent in by F. H. Zouck, chairman of the Maryland State Roads Commission, said: "If we are to face in the next three years as much change in loading and rate of speed upon the public road as we have experienced in the past three years, but very few miles of the present improved roads of this country will be found remaining intact, and with that thought standing boldly before us it is the duty of every person interested in the highway movement to stop, look, listen, pause and consider before venturing further, because if we do not there is bound to come a reaction of public sentiment that may parallel that of the old canal days.

The Truck and the Railroad

"The truck cannot be made to compete with the railroad as an economical proposition. The experience during the past war emergency cannot be made a criterion for future action, except to direct our attention to the danger of overloading the highways. The truck has its place as a feeder to the railroad and as a medium between the farm and the market, but the load limit should be not over 600 lb. per inch width of tire for brick, concrete and asphaltic roads, and not over 400 lb. for the average water-bound macadam road. The load upon earth roads must be governed by the weather and the soil conditions. I would not advocate embargoes, but a loading to correspond with the conditions of the highway.

"I agree with Mr. Graham that when a road is constructed and a few individuals use that road for profit they should bear the cost of maintenance; but if the truck manufacturers insist on increasing the loading over 600 lb. per inch width of tire and advocate heavy-tonnage vehicles, no type of road now in existence will endure sufficient tonnage to be satisfactory in license cost to the truck operator."

C. J. Bennett, state highway commissioner of Connecticut, defined the position of the highway engineer with reference to trucks as follows:

"We appreciate the value of the motor truck. We would not banish it. We know that it holds an important place in the general scheme of transportation. It is extremely useful to us in our own work. We realize that we must build our roads to stand motor-truck traffic. We must also maintain them properly. The only question is, to determine the maximum motor truck for which we must design and construct our highways. Right here, the interests of the highway engineers and the motor-truck manufacturers begin to diverge.

"It is not fair to say that it is all a question of maintenance. Even with unlimited funds, maintenance has not always succeeded in preventing damage by trucks. It does not seem feasible to place embargoes on trucks for a time. We must meet the issue fairly and design a truck for which we can build roads continuously usable.

Effect of Unreasonable Weight

"An attempt to exceed a reasonable weight in motor trucks would do two things: First, make it necessary to replace a large amount of mileage already constructed with expensive construction; and, second, on that account reduce the expansion of the highway systems—for, under present conditions, there is a definite limit to the amount of money which states can appropriate for highway construction.

"My suggestion, therefore, is that the motor-truck interests modify their demand for roads which will stand unreasonable weights, and place their attention upon the development of a maximum standard motor truck which will be reasonable in its weight, the speed at which it can be operated and its width and height."

Connecticut's law, framed before the war, in 1917, represents Mr. Bennett's idea of a liberal regulation. It calls for a 12½-ton total load, 700 lb. per inch of tire width, 9½ ft. total width and a maximum speed of 25 miles per hour.

A resolution was passed appointing a committee to confer with the Motor-Truck Committee of the National Automobile Chamber of Commerce, to decide upon and work for the passage of a uniform motor-truck law.

Reception to Captain Robert W. Hunt on Eightieth Birthday

Capt. Robert W. Hunt, head of the firm of Robert W. Hunt & Co., inspecting and testing engineers, Chicago, was the guest of honor at a reception given at the Mid Day Club, Chicago, Dec. 9, in recognition of his 80th birthday.

Landscape Architects Hold Reconstruction Meeting

A special meeting of the American Society of Landscape Architects was held in Washington, D. C., Dec. 7, to consider problems affecting the profession in the reconstruction period.

"This meeting was called," said Prof. J. S. Pray of Harvard, president of the society, "to consider how we may best be of service here and overseas during the reconstruction period. The country is faced, for instance, by a large building program. Better and more economical results will be secured by the coöperation of the landscape architect. He is likely to be called in more and more upon these and city-planning problems."

It was stated by F. L. Olmsted that the landscape architecture branch of the Housing Bureau had proved the possibility and value of coöperation between the architectural, town-planning, and engineering professions. Mr. Olmsted pointed out that in that branch of the Housing Bureau each of these professions had been represented by a division, all working together in the solution of many problems.

Shipping Board's Annual Report Cautious As To Future

In its annual report to Congress, published Dec. 15, the United States Shipping Board expresses its conviction that the shipbuilding program should be carried through, and it also suggests that the program should be extended. On the latter point, however, it says: "It [the board] feels that until the situation is further developed it should not recommend specifically the degree nor the manner in which the program should be extended. In view of these circumstances, the board deems it advisable to submit to the Congress at a future date its recommendations in these particulars."

As summarized in the report, contracts were made by the Emergency Fleet Corporation during the year for 1604 steel ships totaling 10,514,000 tons, and for 1034 wood and composite ships totaling 3,024,000 tons carrying capacity. The steel vessels include 1297 cargo ships, 80 tankers, 94 troop ships, and a number of other large vessels, besides 112 tugs and 16 barges.

Discuss Bridge Over Chesapeake Bay at Baltimore

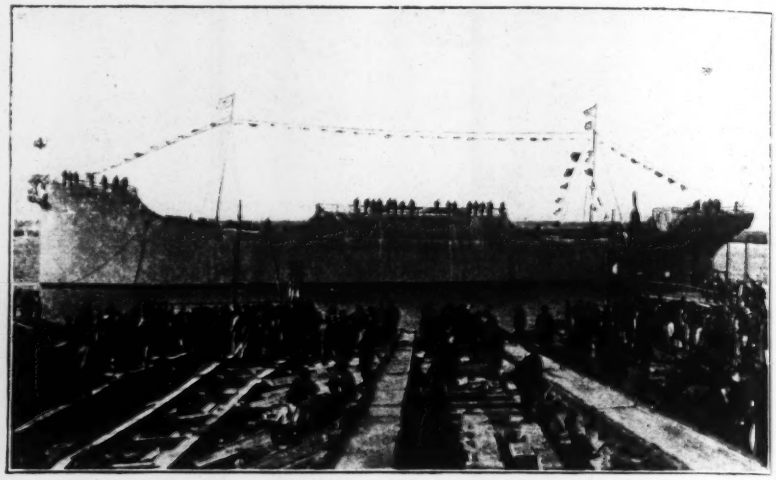
Active discussion by Maryland interests of a project for a bridge across Chesapeake Bay to connect Baltimore with the Eastern Shore, has led to the appointment of a committee by Governor Harrington to develop the scheme in more detail. J. E. Greiner, consulting engineer, Baltimore, is a member of the committee. The proposed route of the bridge is from Bay Shore to a point in Kent County near Tolchester. Some of the plans proposed have in view a double-deck structure nine miles long, costing about $10,000,000.

First Government Concrete Ship Is Launched

The 3000-ton concrete freighter "Atlantus," launched at Brunswick, Ga., Dec. 4, is the first of the Government's concrete oceangoing ships to take the water. This vessel was built under the direction of the Emergency Fleet Corporation, by the Liberty Shipbuilding Co., after designs prepared by the contractor. It was the first and only ship started by the company under its first contract, which was superseded by a later agency contract. Under the latter the company is building concrete ships at a new yard in Wilmington, N. C.

The "Atlantus" was built at an old yard on old end-launching ways. Being the only ship provided for at this site, there was some difficulty in the construction and, in all probability, little economy in cost. As shown in the accompanying views, the boat is much more ship shape than its predecessor in concrete ships, the "Faith."

In the "Atlantus" the new burned-clay light aggregate developed by the Government was used. This aggregate, giving a concrete weighing about 110 lb. per cubic foot, was made in the Birmingham district especially for this ship.



TWO VIEWS OF LAUNCHING OF 3000-TON CONCRETE SHIP "ATLANTUS" AT BRUNSWICK, DECEMBER 4

East San Francisco Bay Cities Study Water Problem

The cities of Oakland, Alameda, Berkeley and Richmond, on the east side of San Francisco Bay, have joined in the appointment of a committee to study and report on the possible sources from which an ample water-supply for the east bay cities might be obtained. It is expected that at least two years will be required to make the field investigation, and it is not expected that the commission will be able to do more than make preliminary plans. The essential thing, it is felt in the east bay cities, is that the four municipalities have come to the point where they can get together in a coöperative plan.

The first meeting of the committee was held on Dec. 2. C. E. Hewes, city manager of Alameda, was elected chairman, and Clyde C. Kennedy, city engineer of Berkeley, was made secretary. Two subcommittees, one composed of city attorneys and the other of city engineers, were named. The subcommittees are to meet once a week, and the joint committee will meet once a month in the Oakland city hall. Other members of the joint committee are: Perry Brown, city engineer, Oakland; Burnett Hamilton, city engineer, Alameda; H. D. Chapman, city engineer, Richmond; D. J. Hall, city attorney, Richmond; E. J. Garrard, councilman, Richmond; H. D. McGlashan, district engineer, United States Geological Survey; C. M. Boynton, commissioner of public works, Berkeley; Earl Sinclair, city attorney, Berkeley; H. L. Hagan, city attorney, Oakland, and Judge St. Sure, of Oakland. The four city engineers were to leave immediately after the first meeting for a trip over the Hetch Hetchy work with M. M. O'Shaughnessy, city engineer of San Francisco.

Weekly Ship Deliveries Reach High Figure

Full reports on ships delivered to the United States Shipping Board during the first week of December show that 22 steel ships were delivered, totaling 131,700 tons, and two 3500-ton wood ships, making the total deliveries of the week 138,700 dead-weight tons. Of the steel ships, nine were requisitioned from private orders; these range in size from 3500 to 12,500 tons. The 13 others, built on Fleet Corporation contracts, include nine Great Lakes vessels of 3500 to 4200 tons carrying capacity.

One particularly fast building record is represented in the list. The 9600-ton cargo ship "Edenton," delivered by the Skinner & Eddy Corporation, Seattle, Dec. 5, was built in 72½ working days, from keel-laying to delivery.

National Road System Recommended

Professional Men at Reconstruction Congress Urge Federal Control, With Payment by Localities

Resolutions recommending a national system of highways were presented to several of the group meetings of the War Emergency and Reconstruction Congress at Atlantic City two weeks ago. Most of them were in general form, but the one adopted by Major Group 10, Industrial Professions, is sufficiently explicit to warrant its reproduction. It reads as follows:

Whereas, at present sections of the country remote from each other are not connected by satisfactory highways, and,

Whereas, it is to the best interest of the nation both in times of peace and war that such highways should be provided without delay, and

Whereas, experience has shown that past dependence on state initiative has proved entirely insufficient and unsatisfactory. Now, therefore, be it

Resolved, that the War Emergency Reconstruction Congress earnestly recommends suitable action on the part of the Federal Government to secure the construction and maintenance of a modern system of well built trunk line highways connecting the Atlantic and Pacific coasts, and the northern and southern sections of the country as well, utilizing existing highways where available and suitable. That a proper system of taxation, having reference to the wealth of the several states served, and their respective benefits, be created with a view to apportioning national expenditures so as not unduly to burden any one section of the country for the benefit of another. And be it further

Resolved, that we recommend that this action be taken as quickly as possible, so that if there be a surplus of available labor from the demobilization of our troops and war industries' employees they may be utilized upon this work.

Proposes an Interstate Port Control for New York

Present Port Development Commission Makes Tentative Draft of Interstate Treaty

As a preliminary move to a unified control of the port of New York which will not stop at state or municipal lines, the New York-New Jersey Port and Harbor Development Commission has just published for public discussion a "Tentative Draft of a Supplementary and Amendatory Treaty between New York and New Jersey." This treaty creates a legal plan for comprehensive development of the Port of New York.

The proposed treaty, an amendment of the existing treaty of 1834, pledges each state to coöperate "in the future planning and development of the port of New York, holding in high trust for the benefit of the nation the special blessings and natural advantages thereof." It makes possible the creation of a "Port of New York District." The treaty does not fix the boundary lines of this district. They are to be fixed by the legislatures of the two states. The treaty creates what is called "The Port of New York Authority," made up of six commissioners, three appointed from each state, who are to constitute a body "corporate and politic," having authority to purchase, acquire, construct, lease and operate any terminal or transportation facility within the district, to make charges and establish rates of toll for the use of the same, and to take, own, hold, lease and operate any kind of property, borrow money and secure the same by bonds or mortgage upon any property held or to be held by it.

Other Provisions of Treaty

It is expressly provided that the treaty is not to affect the legal title to any property now vested in or held by either of the two states or by New York City or any other city, county or village within the district; nor does it affect the revenues now derived by the city from its dock properties. The treaty would authorize the port authority to make orders, rules and regulations within the port district for the improvement of navigation and commerce of the district not inconsistent with the Constitution of the United States or of either state, or with acts of Congress; but it provides a method by which these rules, orders and regulations are to be made effective only after submission to the municipalities within the district for their approval.

The proposed plan does not deal with the physical or economic features of port development. These features are being separately studied by the commission and will form the basis of its report to the legislatures of both states. The treaty is based, however, upon the assumption that the commission will conclude from its study that comprehensive development of port facilities must come through the coöperation of the two states, joining, where necessary, with Federal and municipal authorities, acting through a legally constituted agency vested with broad legal powers, to build, maintain and operate port facilities, to improve commerce and navigation at the port, to borrow money for the purpose, and to deal with all phases of the matter, by public or private ownership or operation, or both.

Charles Piez Succeeds Schwab as Director General

Charles Piez, vice-president and general manager of the Emergency Fleet Corporation during the past year, who has been acting director since the resignation of Charles M. Schwab two weeks ago, was selected as Mr. Schwab's successor, at a meeting of the board of trustees of the Emergency Fleet Corporation in Washington, Dec. 11.

Mr. Piez' duties during the past year have been essentially the supervision of ship construction under control of the Fleet Corporation, the most important part of the corporation's work. He is therefore considered to be thoroughly well prepared for the position of chief authority in the corporation. Bainbridge Colby, one of the trustees, on the part of the board expressed high appreciation of Mr. Piez' share in the corporation's work.

Millions Willed To Study Disease and Promote Health

The residuary estate of Capt. Joseph R. De Lamar, mine owner and capitalist, has been willed in equal parts to Harvard, Johns Hopkins and Columbia Universities, "for the study and teaching of the origin of human disease and the prevention thereof" and for the study and teaching of health conservation through food and diet. Laboratories, lectureships and publications, the last two both scientific and popular, are specified in the will. The estimated value of the residuary estate is $10,000,000, besides which $10,000,000 willed to a daughter of the testator will be added to the fund if the daughter dies without issue.

Seattle Projects Total $12,000,000

Plans for an extension of the water system of Seattle, Wash., the cost of which was estimated some years ago at $3,700,000, have been completed by A. H. Dimock, city engineer. The extension will involve the construction of several reservoirs, tunnels, pipe lines and other works. Preliminary work is being done for the construction of a 36,000-kw. hydro-electric plant on the Skagit River; the plant will cost, it is estimated, $5,500,000. A number of sewerage projects which were postponed on account of the war will amount to about $1,000,000, and about $2,000,000 will be required for the construction of several main thoroughfares of the city, some of which will be commenced at once. In addition, minor improvements will entail the expenditure of a considerable sum.

President Favors Early Resumption of Highway Construction

President Wilson favors the earliest possible resumption and extension of highway construction under the Federal-aid road act, as indicated in *Engineering News-Record* of Dec. 5, p. 1045, and has written to Secretary of Agriculture Houston to that effect. The Secretary of War also has written to Mr. Houston in similar vein. The text of the President's letter follows:

"Dear Mr. Secretary:

"I heartily agree with you that it would be in the public interest to resume in full measure the highway construction operations under the Federal-aid road act, and to do so as speedily as possible. I understand the necessity which existed for their contraction during the stress through which we have been passing, but that obstacle is now removed. I believe that it would be highly desirable to have an additional appropriation made available to the Department of Agriculture, to be used in conjunction, if possible, with any surplus state and community funds, in order that these operations may be extended. It is important not only to develop good highways throughout the country as quickly as possible, but it is also at this time especially advisable to resume and extend all such essential public works, with a view to furnishing employment for laborers who may be seeking new tasks during the period of readjustment. Knowing that the Department of Agriculture and the state highway authorities in each state have been carefully working out road systems and developing plans and specifications, I have no doubt that all activities in this field can be vigorously conducted through these two sets of existing agencies, acting in full accord.

Faithfully yours,

WOODROW WILSON."

Coast Survey Needs Equipment

The need of more equipment for the Coast and Geodetic Survey is pointed out in the annual report of the superintendent of the survey to the Secretary of Commerce, issued Dec. 14. The need of Government-owned power launches for propelling wire-drag surveying apparatus is emphasized. A lay exposition is made of the principles of the wire-drag survey.

ENGINEERING SOCIETIES

The Albany Society of Civil Engineers held its annual meeting and dinner Dec. 17. Maj. James E. Hewes, general manager of the Albany Southern R.R., addressed the meeting on "Army Engineering and Transportation."

The Springfield Engineers' Club, Springfield, Ill., was addressed Dec. 10 by a representative of the National Tube Co. on pipe-manufacturing processes. A moving picture, produced by

Calendar

Annual Meetings

AMERICAN SOCIETY OF CIVIL ENGINEERS; 29 West 39th St., New York City; Jan. 15-16, New York.

AMERICAN ROAD BUILDERS' ASSOCIATION; 150 Nassau St., New York City; Feb. 25-28, New York City.

the National Tube Co., entitled "From Ore to Finished 'National' Pipe," was shown.

The Engineers' Club of Philadelphia will be addressed by Dr. M. W. Franklin on "Peace," at the weekly luncheon on Dec. 24.

The Engineers' Society of Western Pennsylvania has been advised by the City of Pittsburgh of tne acceptance of its deed of dedication for the homestead of the late George Westinghouse, in the Homewood district. The property is deeded to the city as "Westinghouse Park."

The Engineers' Club of Columbus was addressed Nov. 29 by Prof. C. W. Foulke, Ohio State University, who delivered a paper on "The Industrial Value of the Purified Water of Columbus."

The Northwest Master Builders' Association is to hold its second annual meeting in Seattle Feb. 20-21. The association was founded last year and held its first meeting in Tacoma.

The Washington State Good Roads Association will recommend to the consideration of the state legislature a proposal for the building of at least one east and west cross-state highway, and the use of automobile license revenues as a basis for a road building bond issue, in accordance with a resolution passed at the annual meeting held in Pasco Dec. 5. Arthur D. Jones, Spokane, president of the association, outlined plans for a state highway system as a reconstruction measure. The following officers were elected: President, N. B. Coffman, Chehalis; treasurer, Perry L. Sinclair, Ilwaco.

The Virginia Good Roads Association will hold its eighth annual convention in the auditorium of Murphy's Hotel, Richmond, Va., on Jan. 14-16, inclusive. C. B. Scott, state highway engineer, Richmond, Va., is secretary of the association.

PERSONAL NOTES

CLIFFORD OLDER, of Illinois, has been elected president of the Association of Mississippi Valley State Highway Departments. Frank E. Rogers, of Michigan, was elected secretary.

S. W. WAKEMAN, general manager of the Fore River plant, Bethlehem Shipbuilding Corporation, has been made general manager of a new unit of the company, including the Buffalo and Providence works as well as the works at Squantum and Quincy, which constitute the Fore River plants of the company.

WALT DENNIS, principal assistant engineer, Wabash Ry., with headquarters at St. Louis, has been appointed division engineer with headquarters at Moberly, Mo., succeeding W. W. Greenland, appointed superintendent at Moberly, as mentioned elsewhere.

LIEUT. COL. W. D. UHLER, Motor Transport Division, U. S. A., has returned to his work as chief engineer of the Pennsylvania State Highway Commission.

B. M. WILLIAMS has resigned as city engineer, El Paso, Tex. He has been in the city engineering department for the past eight years.

DANIEL B. NIEDERLANDER, formerly chief engineer of the Edgewood Arsenal Plant, Buffalo, recently received appointment as district appraisal engineer for the Bureau of Aircraft Production, at Buffalo.

W. I. JEFFERDS, formerly assistant chief draftsman, Erie R.R., has been appointed resident engineer at Meadville, Penn.

W. W. GREENLAND, division engineer, Wabash Ry., with headquarters at Moberly, Mo., has been appointed division superintendent at the same point. He was formerly assistant engineer at Moberly and in 1915 was appointed engineer maintenance of way of the division.

S. D. CLINTON, bureau of valuation, Interstate Commerce Commission, resigned recently to become associated with the Vulcan Iron Works, Seattle, Wash.

ROBERT W. WADDELL, former assistant city engineer, Kansas City, Mo., has been appointed city engineer. He has been acting head of the engineering department of the city since early in June, at the time of the injury of Curtis Hill, city engineer.

C. O. IRVINE, assistant engineer, Gannett, Seelye & Fleming, consulting engineers, Harrisburg, Penn., has entered the engineering department of the Philadelphia & Reading Railway.

LIEUT. ERNEST W. WOODRUFF, Yonkers, N. Y., formerly of the engineers' staff of the New York City Municipal Bureau of Highways, is reported as severely wounded.

CHARLES E. PHELPS, JR., chief engineer of the Maryland Public Service Commission since its organization in 1910, has resigned to enter private practice. At the time of his appointment as chief engineer of the commission he was in charge of the construction of underground electrical conduits in Baltimore.

OBITUARY

HENRY PRENTICE MORRISON, for three years commissioner of public works, Borough of Richmond, New York City, died Dec. 17 at West New Brighton, N. Y., at the age of sixty-one. He was born in Troy, N. Y., and was graduated from the New York University in 1880, with the degrees of B. S. and C. E. In 1881 he entered the Department of Public Works and a year later was made county engineer for Richmond. In February, 1902, he was appointed deputy commissioner of highways, sewers and water-supply, after which he engaged in private practice.

JOHN STERLING DEANS, vice-president and consulting engineer and previously chief engineer of the Phoenix Bridge Co., died at his home in Phoenixville, Penn., Dec. 16. Mr. Deans became chief engineer of the company in 1892. He was the constructor of many notable structures, including the Pecos River district on the line of the Southern Pacific and the elevated railways of New York City.

JOHN J. CANNON, chief engineer of the Guerber Engineering Co., Bethlehem, Penn., died Dec. 8. He studied at Lehigh University in the class of 1911, and entered the employ of the Guerber Engineering Co. in the frog and switch shops. At the time he was made chief engineer of the company, in 1914, he was head of the estimating department.

CHARLES P. BROOKS, consulting engineer, Salt Lake City, died in that city Nov. 30. After his graduation from the Sheffield Scientific School, Yale University, in 1870, he entered the office of the city engineer of New Haven, Conn., and two years later became locating engineer for the Texas & Pacific R.R. Soon afterward he became connected with the city engineering department of Chicago. In 1874 he formed a partnership with R. H. Brown in Salt Lake City, known as Brown & Brooks. He had served as a member of the Salt Lake City Board of Health, as county surveyor of Salt Lake County and as consulting engineer for the Board of Public Works on the construction of the Salt Lake City sewage system. In recent years he was identified with mining interests.

A. R. W. SPERRY, who was appointed chief engineer, Anderson-Cottonwood Irrigation District, California, early in 1917, died in Stockton, Dec. 6.

ROBERT P. ABENDROTH, assistant engineer of the Queens County, New York, topographical bureau for the past 14 years, died in Flushing, N. Y., Dec. 11. He was 53 years old.

GEORGE S. CANFIELD, JR., previously deputy engineer, Spokane County, Washington, died recently in Spokane.

NEWS OF ENGINEERING INDUSTRIES

FOR MANUFACTURERS WHO SERVE ENGINEERS AND CONTRACTORS

Financial Help to Latin America Appreciated

Will Act as Factor for Developing Trade—Has Been Studied by Commerce Department

The willingness of foreign capitalists to assist in the development of Latin-American resources has created a favorable attitude on the part of the citizens of southern countries and has opened the way for other business, according to recent Commerce Reports. The conservation of resources in the European investment markets stopped the exportation of capital at the beginning of the war, and made it necessary for the Latin republics to depend on the United States for their financial needs; American capital has already made possible the development of some of the largest mining and railroad properties in South America.

The interests of the United States in South America before the war, other than in mines and the packing industry, were negligible. Most of the capital came from Great Britain, France, Germany, Belgium and the Netherlands, and it is a matter of some interest, (and perhaps significant), states the Commerce Report, that Great Britain during the several months immediately preceding the outbreak of the war placed larger sums in the Argentine than in the United States. During the lull that followed the closing of the various stock exchanges in Europe attention was given by American financial interests to Latin America, and the first steps were taken to establish American interests in that field.

South America's Undeveloped Wealth

The undeveloped wealth of the various South American countries consists of minerals in all the republics, extensive forest resources in all (except possibly Uruguay), oil deposits, which have been found in almost every country and are worked commercially in Argentina, Colombia, Chile, Ecuador, Peru and Venezuela. There is a vast amount of undeveloped water power.

On the pre-war investment list Great Britain leads with an amount of almost $5,200,000,000. The report states that the exact extent of French investment is not known, but it is estimated to be between $1,500,000,000 and $1,700,000,000, placed in Argentine and Brazilian railways, mines and railways in Bolivia, Federal and state loans in Brazil, and other investments in Ecuador, Colombia, Chile and Venezuela. It is stated that French engineers are at present building a railway to link Argentinian and Bolivian railways.

Germany's chain of banks and her pre-war merchant marine gave her an important place in Latin America, according to the Commerce Report. With the exception of its banks the most important of its investments are in the public utility field. Electric railways and other properties in Buenos Aires, tramway lines in Montevideo, Uruguay, and other electrical properties in Argentine and Chile, probably make up the largest public utility group in Latin America. It is stated that although the great railway of Venezuela from Valencia to Caracas is the only German railway of importance, German interests in other fields are numerous.

Canada has taken an important part in development of the traction and electric lighting properties of Rio de Janeiro and Sao Paulo, Brazil, and public utilities in British Guiana, Trinidad and Jamaica.

How Germany Won Place

Although, as noted above, the English held the first place in South American investments before the war, it is well known that German methods and activities were giving Germany a place of ever-increasing importance. This was being accomplished by her chain of banks, the sphere of activity of which was much more extensive than that of either the American or English institutions. The services rendered were granting credit, discounting long bills, making loans and advances on raw materials, shipments of manufactured goods, etc., opening or confirming commercial credits as required, guaranteeing prompt payment of contracts, etc. It has been pointed out that the establishment of this network of foreign banks saved Germany much of the money formerly paid to England for the negotiation of foreign bills, and that Germany's participation in the development of many foreign industrial, railway and mining enterprises has created markets for a great variety of her exports.

Knowledge of Conditions Needed

The report states that it is not to be inferred that Americans are recommended to make themselves over after the German model. Americans with their enormous home market are not under the same pressure as the Germans, but the German example teaches that fundamental knowledge of South American conditions should be acquired.

All of the European countries so handled the credits that the machinery, raw materials and other supplies used to construct public utilities were purchased in their respective home countries.

Two Sections of Industries Board Now in Commerce Department

The resources and conversion section and the conservation division of the War Industries Board are now incorporated permanently in the Department of Commerce. This action was taken at the direction of President Wilson. The bulletin making the announcement states that "the function has been 'the studious conservation of resources and facilities by scientific, commercial and industrial economies.' The material gathered and the staff developed will enable the Department of Commerce to carry on the work of eliminating waste and promoting precision in business."

Lumber Dealers Offer Sales Service to Government

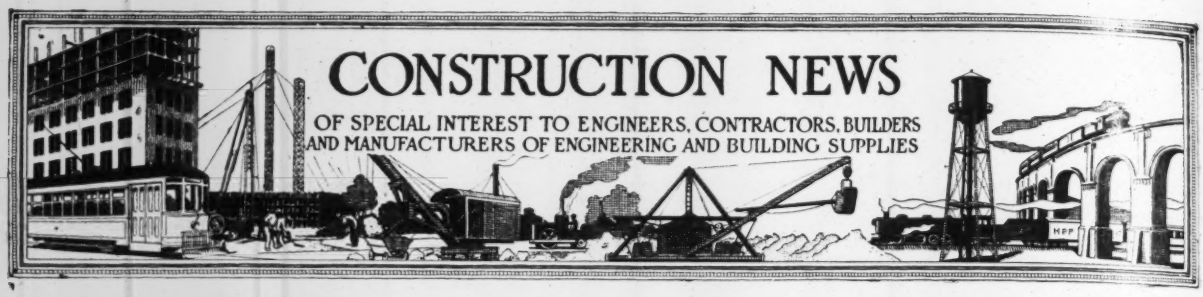
The sales service of the National Bureau of Wholesale Lumber Distributors has been offered to the United States Government to assist in the disposal of the surplus lumber which, by reason of the ending of the war, will be of no further use in war construction. The offer was made to Brig. Gen. R. C. Marshall, Jr., of the Construction Division of the United States Army, by the bureau, at a meeting held recently in Chicago. The offer was made in view of the disastrous effect on the lumber industry if the disposal of this lumber is not made in a manner calculated to create least disturbance in conditions.

Two Large Steel Industries Planned for Gary, Indiana

Announcement is made that the National Tube Co. will erect a $25,000,000 plant and the American Car & Foundry Co. a $10,000,000 plant, both at Gary, Ind. These companies are subsidiaries of the United States Steel Corporation. It is stated the plants will be consummations of plans laid before the beginning of the war in 1914.

Results of Daylight Saving Shown

The results of daylight saving are shown in figures collected by the Washington Gas Light Co., District of Columbia. The company found that the people of the district saved $60,000 in gas bills since Mar. 21, when the daylight saving bill went into effect. Basing estimates on these figures, it is considered that the conservation of gas throughout the United States will amount to a saving of $2,000,000. In the matter of gas and electricity the saving was no less than 10 per cent of the money formerly spent for them.


CONSTRUCTION NEWS
OF SPECIAL INTEREST TO ENGINEERS, CONTRACTORS, BUILDERS
AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES

PROPOSALS

For Proposals Advertised See Pages 59-61 inclusive

WATER-WORKS

Bids Close		See Eng. News-Record
Dec. 31	Cohoes, N. Y.	Dec. 19
Jan. 2	Galesburg, Ill. Adv. Dec. 5 and 12.	Dec. 12
Jan. 7	Inverness, Miss.	Dec. 19
Jan. 10	Houston, Tex.	Dec. 12

SEWERS

Dec. 19	Long Island City, N. Y.	Dec. 12
Dec. 23	Long Island City, N. Y.	Dec. 19
Dec. 30	Morrillton, Ark.	Dec. 19

BRIDGES

Jan. 2	New Brunswick, N. J. Adv. Dec. 12.	Dec. 12
Jan. 3	Great Bend, Kan.	Dec. 19
Jan. 6	Tulsa, Okla. Adv. Dec. 12.	Dec. 12

STREETS AND ROADS

Dec. 21	Fort Pierce, Fla.	Dec. 19
Dec. 24	Jersey City, N. J.	Dec. 19
Dec. 27	Pittsburgh, Pa.	Dec. 5
Dec. 29	Great Bend, Kan.	Dec. 5
Jan. 3	Great Bend, Kan.	Dec. 19
Jan. 4	Johnstown, Pa.	Dec. 19
Jan. 6	Mangum, Okla.	Dec. 19
Jan. 6	Tulsa, Okla. Adv. Dec. 12 and 19.	Dec 12
Jan. 15	Blytheville, Ark.	Dec. 5

EXCAVATION AND DREDGING

Dec. 21	California, Mo.	Dec. 19
Dec. 23	New York, N. Y.	Dec. 19
Dec. 23	Caruthersville, Mo. Adv. Dec. 5 and 12.	Dec. 12
Dec. 30	Waseca, Minn.	Dec. 19
Jan. 3	Brownsville, Tenn.	Dec. 12
Jan. 3	Terra Ceia, N. C. Adv. Dec. 12.	Dec. 12
Jan. 7	Albany, N. Y. Adv. Dec. 12 and 19.	Dec. 12
Jan. 9	Bridge Junction, Ark.	Dec. 12
Feb. 3	Madisonville, Ky. Adv. Dec. 5, 12 and 19.	Dec. 12

BUILDINGS

Dec. 23	Flushing, N. Y.	Dec. 19
Jan. 14	Cherokee, Ia.	Dec. 19
Feb. 3	**St. Paul, Minn.**	**Oct. 31**

FEDERAL GOVERNMENT WORK

Dec. 23	Pier and Bulkhead — Spec. 3663—Alexandria, Va.	Dec. 5
Dec. 23	Septic Tank—Spec. 3664—Miami, Fla.	Dec. 5
Dec. 23	Tanks—Spec. 3414—Rockaway, N. Y. Adv. Dec. 5 and 12.	Dec. 12
Dec. 23	Extension to Heating System and Power Plant — Spec. 3666 — Paris Island, S. C.	Dec. 12
Dec. 23	Altering Marine Barracks — Spec. 3514 — Ft. Mifflin, Pa.	Dec. 12
Dec. 23	Annex to Dispensary—Spec. 2588—Indianhead, Md.	Dec. 12
Dec. 23	Officers Quarters — Spec. 3677 — South Charleston, W. Va.	Dec. 12
Dec. 23	Kitchen and Mess Hall Equipment — Spec. 3684 — Philadelphia, Pa.	Dec. 12
Dec. 23	Boiler House, Heating and Drainage Systems, etc. — Spec. 3612 — Chatham, Mass.	Dec. 12
Dec. 23	Extending Pneumatic Tube System — Spec. 3658 — Hampton Roads, Va.	Dec. 12
Dec. 23	Wood Pier and Approach—Spec. 3491—Yorktown, Va.	Dec. 12
Dec. 30	Shop and Industrial Buildings—Spec. 3675—Galveston, Tex	Dec. 5
Dec. 30	Radial Block Chimneys — Spec. 3712 — Washington, D. C.	Dec. 19
Dec. 30	Radio Building, Garage, Barracks, etc.—Spec. 3683 —Monroe, N. C.	Dec. 12
Dec. 30	Additional Buildings—Spec. 3686—Cape May, N. J.	Dec. 12
Dec. 30	Cranes—Spec. 3681—Washington, D. C.	Dec. 12
Dec. 30	Boilers—Detroit, Mich. Adv. Dec. 12 and 19.	Dec. 12
Dec. 30	Quarters for Marine Officers Spec. 3717 — Iona Island, N. Y.	Dec. 19
Dec. 30	Altering Court House, — Montgomery, Ala.	Dec. 19
Dec. 30	Nurses Quarters—Stapleton, N. Y. Adv. Dec. 12 and 19.	Dec. 19
Dec. 30	Extensions "A" to Power Plant — Spec. 3632 — New York, N. Y.	Dec. 19
Dec. 30	Photographic Laboratory—Spec. 3692 — Key West, Fla.	Dec. 19
Dec. 30	Oil Storage Building, etc.—Spec. 3714 — Hampton Roads, Va.	Dec. 19
Dec. 30	Deepening Waterways — New Orleans, La. Adv Dec. 12 and 19.	Dec. 19
Jan. 2	Lavatory Annexes—Washington, D. C.	Dec. 12
Jan. 3	Post Office—Park City, Utah	Dec. 5
Jan. 3	Post Office—Newburyport, Mass.	Dec. 5
Jan. 3	Post Office—Mt. Carmel, Ill.	Dec. 5
Jan. 6	Post Office — Bakersfield, Cal.	Dec. 5
Jan. 6	Post Office — Lancaster, S. C.	Dec. 5
Jan. 6	Post Office—Caribou, Me.	Dec. 5
Jan. 6	Hangars, Pavement and Beach — Spec. 3432 — Galveston, Tex.	Dec. 19
Jan. 6	Railroad — Spec. 3718 — Bellevue, D. C.	Dec. 19
Jan. 6	Railroad Track—Spec. 3265 —Hingham, Mass.	Dec. 19
Jan. 7	Post Office — Woodbury, N. J.	Dec. 5
Jan. 7	Post Office—Fremont, O.	Dec. 5
Jan. 7	Post Office and Court House —Alexandria, La.	Dec. 5
Jan. 8	Post Office—Prescott, Ark.	Dec. 5
Jan. 8	Post Office—Cody, Wyo.	Dec. 5
Jan. 8	Post Office — Waterloo, N. Y.	Dec. 5
Jan. 9	Post Office—Orange, Tex.	Dec. 5
Jan. 9	Post Office — State College, Pa.	Dec. 5
Jan. 9	Post Office and Court House —Durango, Colo.	Dec. 5
Jan. 10	Post Office — Front Royal, Va.	Dec. 5
Jan. 10	Post Office—Vineland, N. J.	Dec. 5
Jan. 13	Additional Buildings—Spec. 3611—San Diego, Cal.	Dec. 19
Jan. 13	Post Office—West Point, Ga.	Dec. 5
Jan. 13	Post Office and Custom House—Ft. Fairfield, Me.	Dec. 5
Jan. 13	Post Office and Court House —Globe, Ariz.	Dec. 5
Jan. 14	Post Office — Southbridge, Mass.	Dec. 5
Jan. 14	Post Office—Cherokee, Ia.	Dec. 5
Jan. 14	Post Office—McKees Rocks, Pa.	Dec. 5
Jan. 15	Post Office — Long Island City, N. Y.	Dec. 5
Jan. 15	Post Office—Kenton, O.	Dec. 5
Jan. 15	Post Office — Bellefourche, S. D.	Dec. 5
Jan. 15	Post Office — Winchester, Mass.	Dec. 5
Jan. 16	Post Office—Eldorado, Kan.	Dec. 5
Jan. 16	Post Office—Shawnee, Okla.	Dec. 5
Jan. 17	Post Office—Franklin, Pa.	Dec. 5
Jan. 17	Post Office—Cohoes, N. Y.	Dec. 5
Jan. 17	Post Office—Buffalo, Wyo.	Dec. 5
Jan. 20	Post Office — Harrisonville, Mo.	Dec. 5
Jan. 20	Post Office—Owego, N. Y.	Dec. 5
Jan. 20	Post Office—Sunbury, Pa.	Dec. 5
Jan. 20	Post Office—Decatur, Ala.	Dec. 5

MISCELLANEOUS

Dec. 20	Semi Trailers — Brooklyn, N. Y.	Dec. 12
Dec. 20	Extending Bulkhead — Brooklyn, N. Y.	Dec. 12
Dec. 23	Elevated Railway—Philadelphia, Pa.	Dec. 5
Dec. 23	Shaft—New York, N. Y.	Dec. 12
Dec. 27	Electrical Equipment—Jersey City, N. J.	Dec. 12
Dec. 27	Blanket—New York, N. Y.	Dec. 19

Where name of official is not given, inquiries should be addressed to City Clerk, County Clerk or corresponding official.

Water-Works

PROPOSED WORK

Conn., East Hartford (Hartford P. O.)—East Hartford Fire Dist. has been authorized to borrow $100,000 to build pump pipe line to increase present water supply. C. H. Olmsted, East Hartford, engr.

Conn., Waterbury—City sold $400,000 bonds to improve water system. C. B. Tomkinson, city clk.

N. Y., New York—N. J. Hayes, comr. water supply, gas and electricity, Municipal Bldg., rejected only bid received Dec. 7, furnishing, delivering, and laying 12-in. water main across East River from East 140th St. to North Brothers Island and hauling and laying water mains in East 140th St. and North Brothers Island, Bronx Boro., same exceeding appropriation. New bids later. Noted Dec. 12.